THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2478.] LONDON, NOVEMBER 8, 1910. [62ND YEAR. PRICE 6d.

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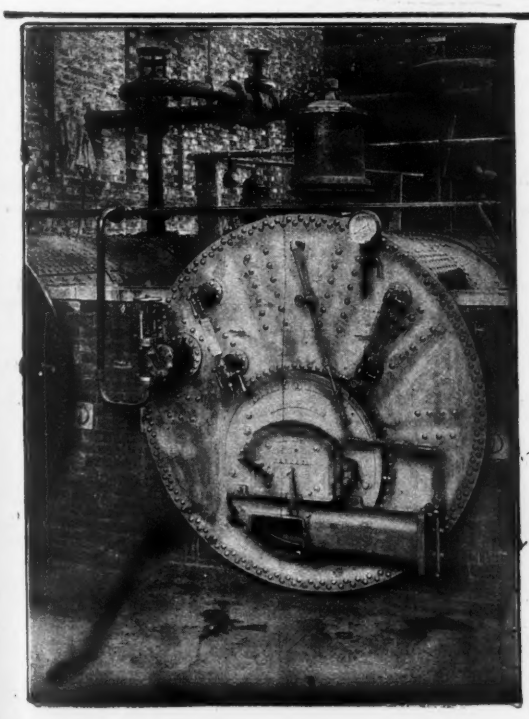

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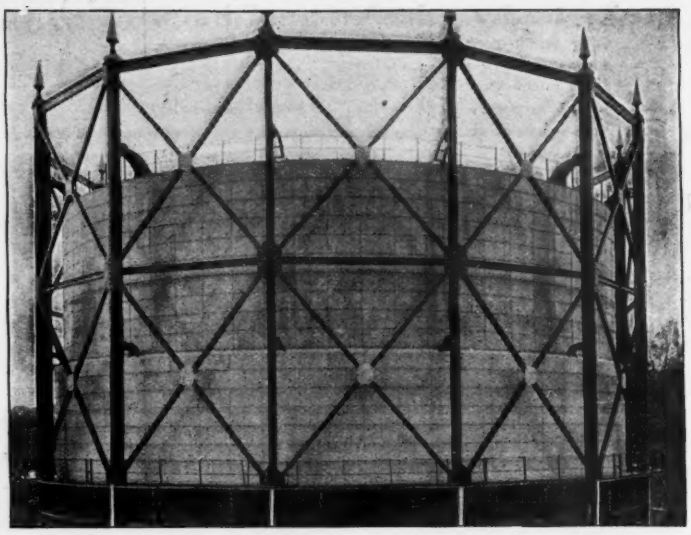

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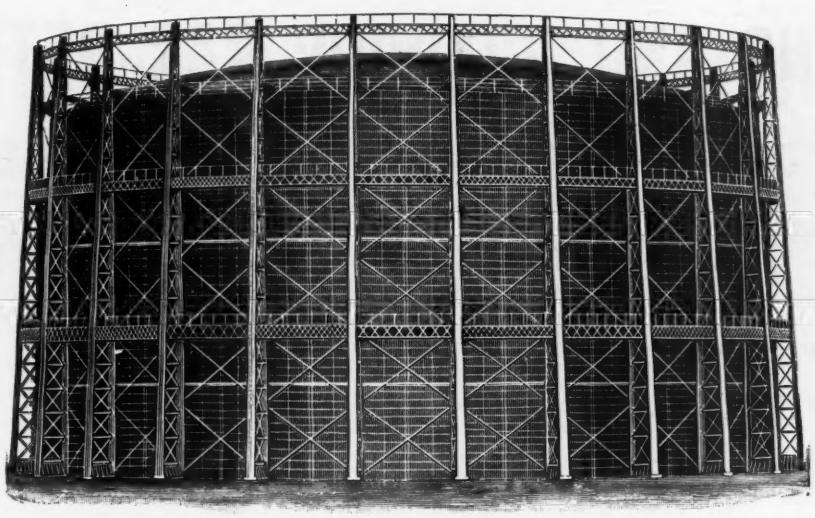

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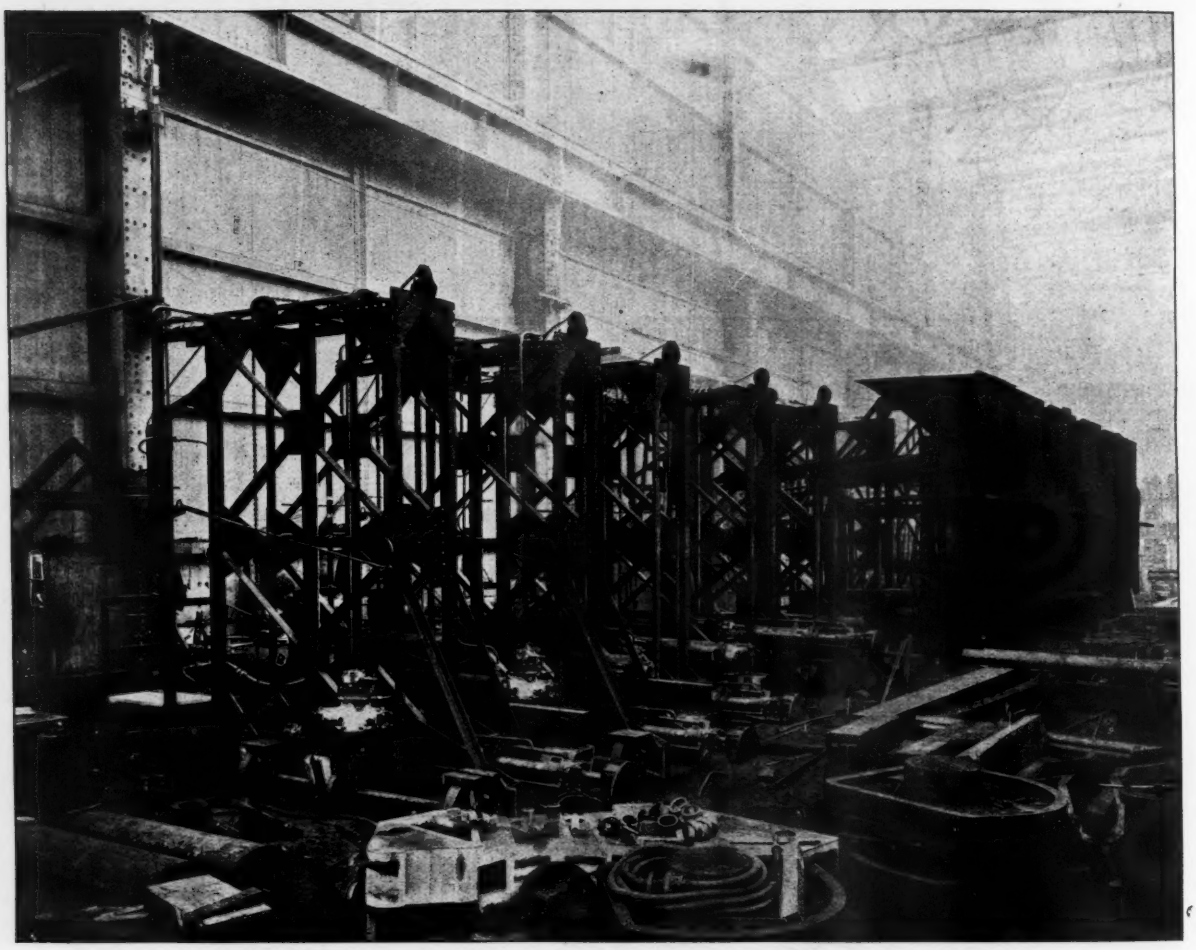

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Standard "MEDIUM" Size.

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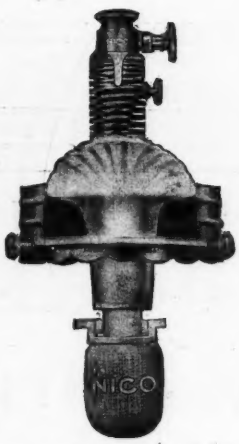

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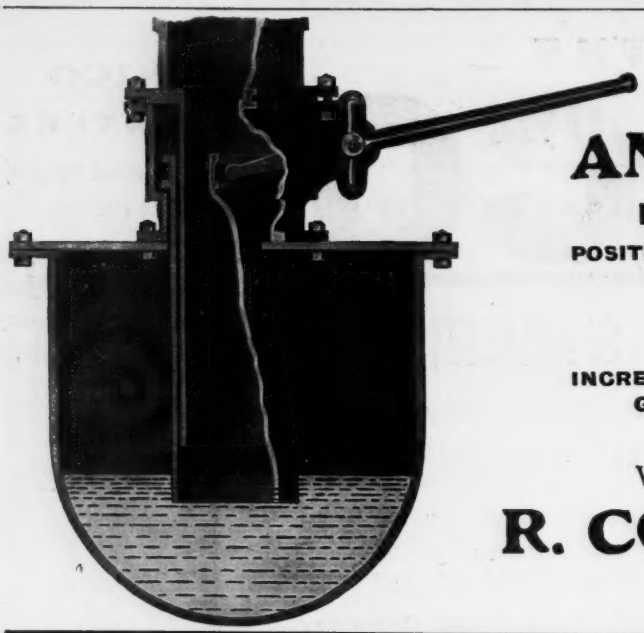

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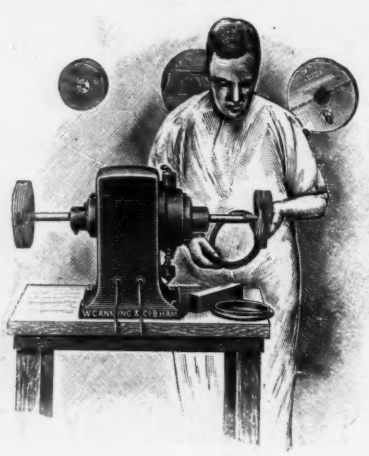

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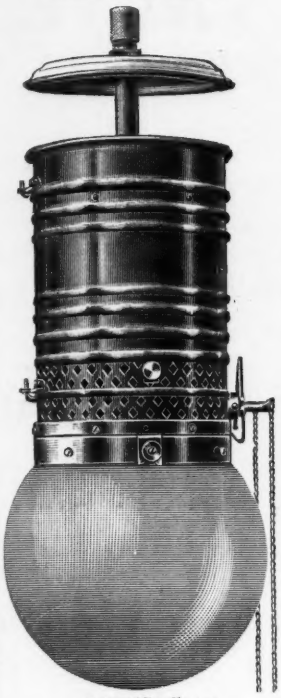

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ARE YOU READY to give your customers the light which will make them glad there is a Gas Company in their city? When you choose a Life-Partner you naturally give considerable attention to appearance. When you buy a Gas Lamp it is your duty to consider not only appearance, but cost of operation—ease and cost of maintenance—simplicity—flexibility to change of pressure—durability—first cost.

The American 1910-A Inverted Gas Arc Lamp is simplicity itself. Great thought has been given in designing this lamp to incorporate labour-saving devices and eliminate intricate adjustments.

The Ventilator is made in two vertical hinged sections, which may be easily opened, removed if desired, and locked automatically.

The Valve may be removed for cleaning by loosening ONE set screw and turning a hexagon nut. No springs to get out of order.

Pilot is easy to adjust and will not blow out.

All working parts accessible, removable, and interchangeable, even while lamp is in operation.

Each Burner has a Separate Gas Adjustment which may be locked after correct incandescence is obtained.

Mantles are suspended in a plate which raises and lowers on two guide rods—No Jar—No Warping—Great Saving in Maintenance Costs.

Porcelain Burner Noses are held firmly in position by a German Silver Cap—They cannot fall out.

Light Distribution Test, 4-burner lamp, 487 Candles on 12½ feet of gas.

If you have tried these lamps, you are ready to meet the demand of a Light-Wanting Public. If you have not tested them, there is a pleasure in store for you.

You want the lamp that from every viewpoint will best serve your Customers and your Company. You want the American 1910A.

The lamp is right, the price is right, the time is right, and we are ready to fill your orders.

To give you an opportunity of seeing this wonderful lamp, and save us the cost of travelling expenses, we will supply one lamp upon a seven days' trial free of any charge to you, an unprecedented opportunity. GRASP IT NOW.

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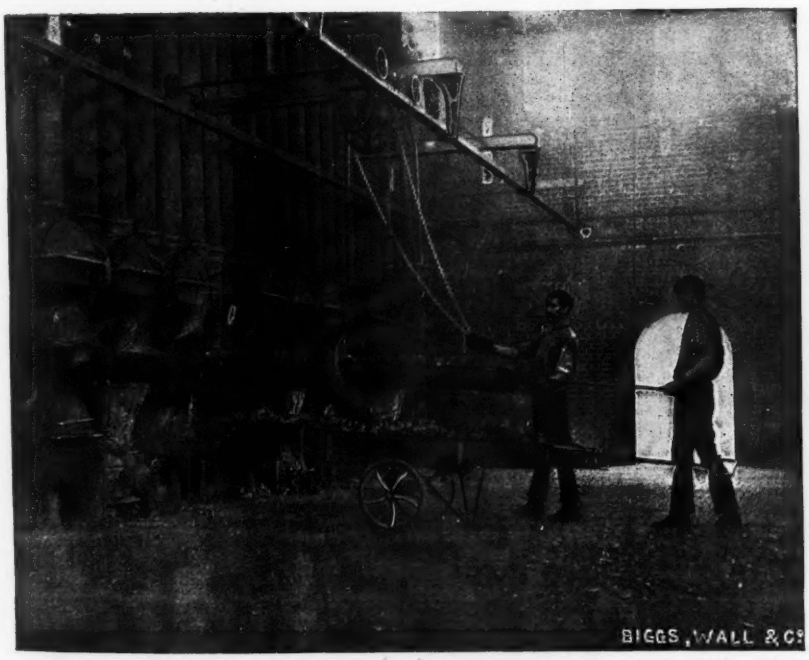
SIMPLE AND INEXPENSIVE.



"RAPID" MANUAL CHARGER AND SCOOP CARRIAGE WORKING AT BRENTWOOD GAS-WORKS, ESSEX.

INCREASED YIELD OF GAS and REDUCTION OF FUEL CONSUMPTION.

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Also for name of Works where you can see Machines in operation.

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HYDRAULIC,

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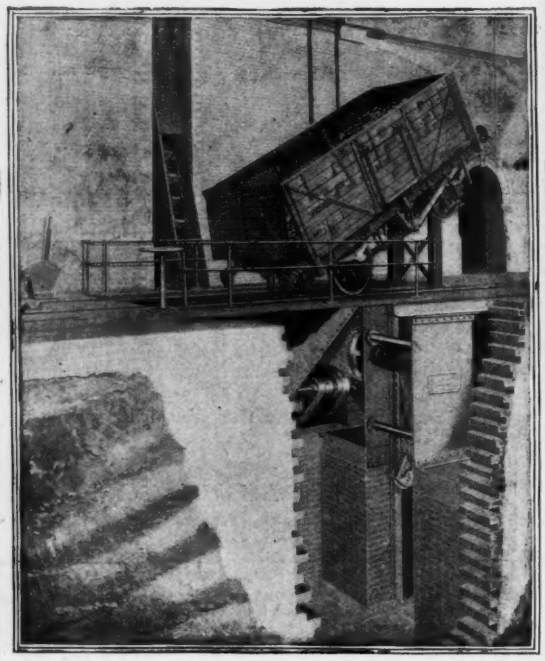
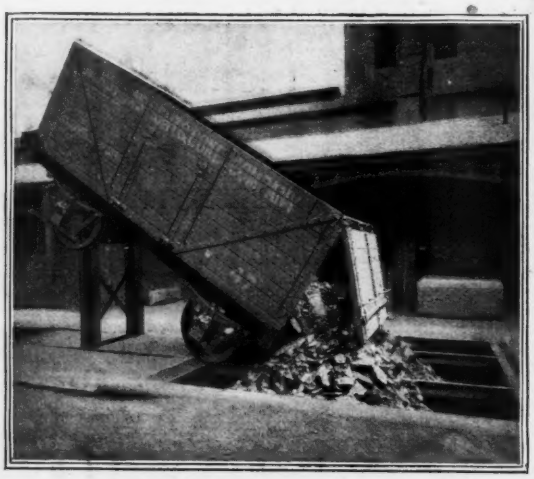


Many installed in conjunction with Coal Handling Plants, giving in every case entire satisfaction.



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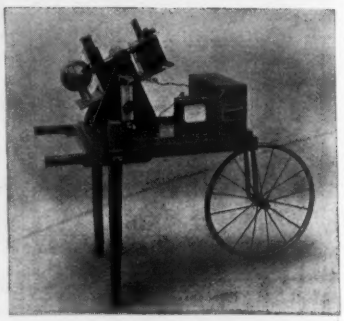
Accurate & Simple.



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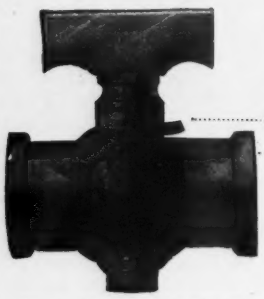

FIG. 1. The Old Style with the Old Trouble.
Note the Pin **A.**

EVERED'S PATENT "SAFETY STOP."

Buyers of Gas Fittings are familiar with the trouble constantly arising through the Stop Pin of the Tap or Cock getting bent or broken, or falling out, thus leaving the Tap without a Stop, and leading to great danger of an escape of Gas.

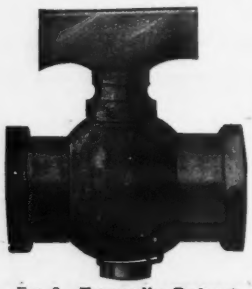

FIG. 2. **Evered's Patent "Safety Stop."** No Pin. No trouble.

EVERED'S PATENT "SAFETY STOP"

renders the old Stop Pin unnecessary and is an absolutely **Safe and Permanent Stop.**

The projection shown in Fig. 3, marked **B,** working in the recess shown in Block, allows the Tap to be turned only so far as the recess extends. There is no possibility of the Tap turning further round as there is no Pin to become displaced or broken.

Any fitting specifically so ordered will be made with the "Safety Stop."

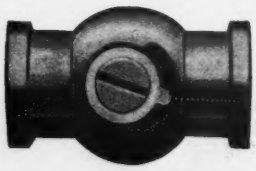

FIG. 3. Underside showing "Safety Stop" in lieu of Pin.

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27 to 35, DRURY LANE,

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Surrey Works, SMETHWICK.

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NAPHTHALENE SOLVENT.

Are you troubled with **NAPHTHALENE** in your **MAINS?** If so, try our special

"SOLVENE."

THE FINEST NAPHTHALENE SOLVENT.

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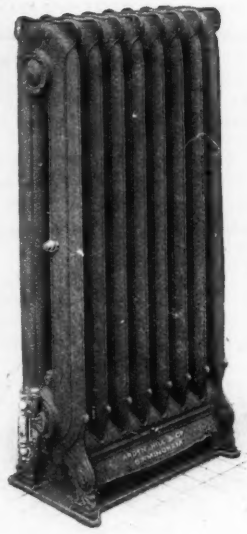
Each Successive Season

witnesses the rapidly growing popularity of the **"MARS"** RADIATORS.



There are good reasons, and here is one—

These Radiators are so constructed that the gas flame cannot impinge on the underside of the loops, and so perfect combustion is ensured.

The "MARS" is, therefore, absolutely odourless!

Other reasons will follow.

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G. I. C. Special Ramie Mantles are now being supplied for Maintenance purposes only, at **reduced prices,** for In-Door, Out-Door, and High-Pressure Lighting, **without irksome Contracts,** or binding engagements, many of our friends in the **Gas Industry** having proved by repeated tests, and in face of the keenest competition, that these Mantles are the Best and Cheapest for all known Burners.

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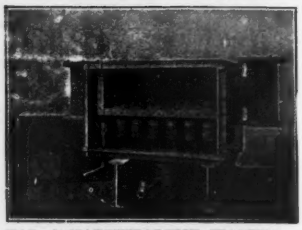

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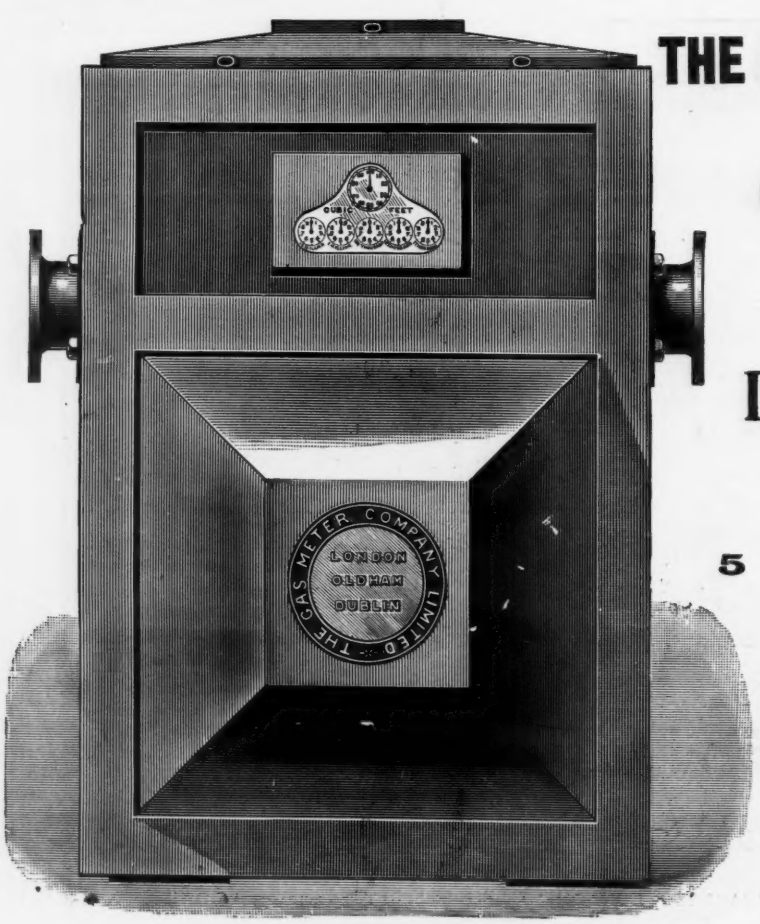

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ALL SIZES IN STOCK.

5 Years' Guarantee.

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The Day-Load Problem!

YOUR Customers will use Gas Stoves far more if you prove to them that Gas Cooking and Heating is the most economical as well as the healthiest and cleanest way. What is wanted is a

FOSTER GAS GOVERNOR

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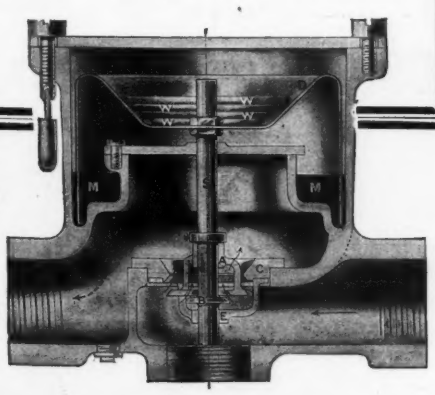

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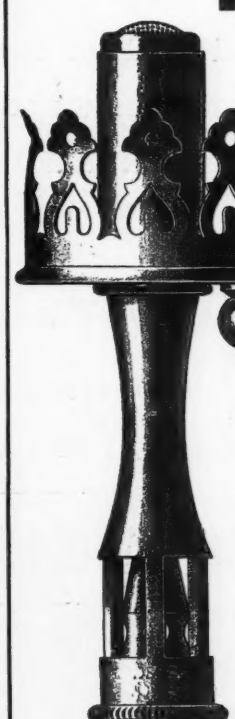

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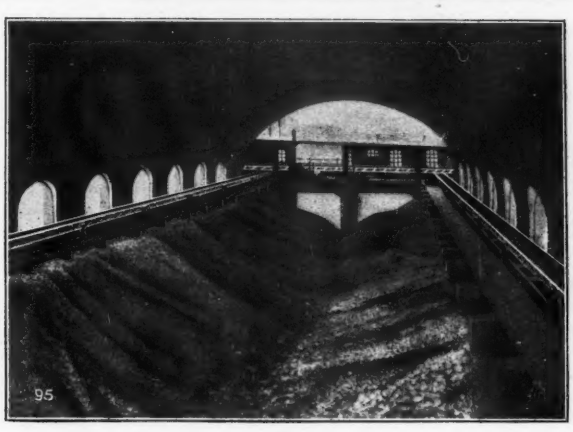

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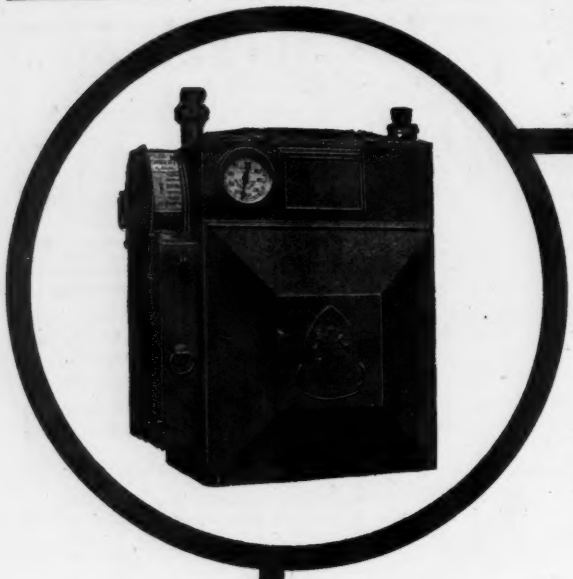

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VOL. CXII., No. 2478.—TUESDAY, NOVEMBER 8, 1910.

EDITORIAL NOTES—GAS, &c.

The Standard Burner Bills.

Active Assistance Imperative.

DUTY calls! It is impossible to too strongly urge upon the administrators and officials of gas undertakings throughout the country the importance of taking steps, in the defence of the interests of the whole gas industry, to defeat the opponents of the Standard Burner Bills in their last and strenuous endeavour to overthrow these measures, which have withstood the fiercest possible attack through their parliamentary career to the present and final stage, which, in other circumstances, would be a simple formality. Opposition now, as we have said before, savours of pure vindictiveness; and the opponents are unfortunately not at all particular as to the methods they employ in gaining their end. Their present action is unjustifiable and is entirely antagonistic to fair play and justice. They are attempting to go behind the verdicts of the Committees of the House of Lords and the House of Commons, and are trying to enlist the votes of a tribunal the majority of the members constituting which do not understand the question, through not having heard the evidence for and against the Bills such as was submitted to the Committees.

Influence, and not argument or evidence, is the weapon that is now being employed in the effort to cancel the success of the Bills, which, it is of the utmost importance to the gas industry as a whole, should be entered upon the Statute Book this session. Perforce, though much against the grain in such a matter as this, the only method open to the promoters is to meet the present action of the opponents by asking that all possible influence shall be brought to bear upon Members of Parliament to vote in favour of the Bills, and so support the verdict of one of their own Committees, uphold the custom of the House in dealing with Bills ratified as these have been, and protect Committee procedure from the designed violation. We have to recognize that Local Authorities and their chief officials—the Town Clerks—are in an exceptionally strong position in getting the ear of local Members of Parliament. From several quarters it is heard that the Liverpool Corporation are communicating with local authorities throughout the country—whether or not interested in the matter of the standard gas-burner—with the view of getting them to stir up their Members of Parliament to oppose the consideration. We can quite imagine—and this is a bad feature of the fresh tactics—that many Town Clerks will take upon themselves the responsibility of writing to Members of Parliament asking for support to the opposition merely because they are desired to do so by the Town Clerk of Liverpool. Already, we believe, in several cases—we know that it was so on second reading—Members of Parliament have pledged themselves to oppose the consideration without making any inquiries whatever into the matter. And this is what passes for statesmanship among some—we hope very few—Members of Parliament.

In the interests of the gas industry, the Gas Committees of local authorities throughout the country should object to the Clerk or Town Clerk making any communication whatsoever to Members of Parliament on the subject; and where Town Clerks have without formal instruction sent appeals to Members of Parliament, and the information of this having been done is obtained, the question of authority should be raised in the Council Chambers. All gas companies throughout the country should also use their influence—at once—with their local Members of Parliament and with their gas shareholders who are also members of the House to obtain their support to the Bills. It is important. It is a case in which—unfortunately, but imperatively—like must be met with like. There is no alternative.

We make this appeal to supplement one that is now being issued by the Parliamentary Agents of the Bills (Messrs. R. W. Cooper and Sons) to all gas undertakings with an output of over 10 million cubic feet. The consideration of the Bills stands adjourned to the 15th inst.; but the date for the discussion has not yet been fixed. It will, however, be recognized that no time must be lost. The opponents are hard and actively at work. Their action, after the fair trial of the question in both Houses, is nothing short of an iniquitous attempt to degrade parliamentary procedure in respect of Private Bill Legislation. On all grounds, everything that can be done must be done to frustrate them; and we hope Members of Parliament will rise superior to the singularly false position in which the vindictiveness of the opponents of the Bills seeks to place them. Once more we urge all gas companies to immediately take the action that they are fortunately in the position to take.

Reflections.

IT is a poor gas-works, and poor administrative and engineering policies, that do not reflect something from which every technical and commercial man connected with the industry can learn something. We hazard the opinion, with a considerable amount of assurance, that there were few, if any, of the members of the Manchester District Institution of Gas Engineers who visited the Stretford Gas Company's works last Saturday week (as already fully reported in the "JOURNAL"), and who were subsequently present at the luncheon to which they were invited by the Board of the Company, and heard the breezy, broad-minded speeches of the Chairman (Mr. Lewis Galloway) and of the Deputy-Chairman (Mr. W. A. Nicholls), who did not add something to the knowledge that they before possessed. We are not holding up the Stretford works, nor the engineering and commercial policies, as paragons of their kind. They are but an example of many others, in which there are individual characteristics that produce certain effects. By their fruits we know them; and the fruits of the Stretford Gas Company are something of which the Board and their Engineer (Mr. H. Kendrick), the President of the Manchester Gas Institution, may well be proud. They reflect worthily upon the Engineer, and upon a Board having true co-operative relationships with their chief technical and commercial adviser. The policy of the Board, and the broad view they take of the affairs of the industry, were reflected in the speech made at the luncheon by the Deputy-Chairman. Would that all Boards of Directors and Committees were animated by the same spirit. If it were so, the gas industry would have fewer of those obstructive boulders in the path of progress that short-sightedness and reticence to afford help for the general good place there.

Mr. Galloway, Mr. Nicholls, and their colleagues can see no finality in the gas industry; and they recognize that "a "rest and be thankful policy" is the best possible for bringing about a premature check to advance. The inherent vitality of the gas industry has been markedly disclosed during the last few years; and the position it has attained in the general economy of things is the most amazing part of the history of gas manufacture and supply during those years in which it has had to meet a competition from electricity conducted on lines and principles that are unusual in the ordinary competitive strife of the business world. In the case of Stretford, the economy reached is seen in the production now of above 12,000 cubic feet of gas, per ton of coal carbonized, of good illuminating and calorific qualities, and selling for power and lighting at prices between 1s. 11d. and 2s. 3d. In the liberal commercial methods, in the plans adopted for ensuring the satisfactory use of the appliances sent out to the consumers, we trace some of the causes contributing to the approximately 50 per cent. daylight load in the summer, and a load working gradually up to the same ratio in the winter. Results such as these speak loudly. They are of the hard facts that refuse to be ignominiously dismissed and belittled. Boards of directors and committeemen must be sympathized with for a deficiency of mental capacity if they cannot recognize the causes and the forces, together with the sources, contributing to these things. The

individual is the main source, and upon him rests the responsibility. But the initiative of the individual and the capacity for good must have, in varied degree truly, their limits. But beyond there is technical organization and co-operative effort. There is the reflection in the speeches of the Stretford Chairman and Deputy-Chairman that, giving encouragement in these directions, is, apart from the immediate concerns of their own undertaking, one of the best ways of contributing to the individual and collective good of the numerous units that go to make up that which we combine under the single title of the gas industry.

We look to other parts of the proceedings on the occasion of this particular meeting. There is one direction in which they reflect work that calls for pursuit. An important work in the interests of the gas industry is the provision of facilities for the broadening of knowledge among the technical and commercial juniors. The report that was presented regarding the Manchester University lectures only reiterated intelligence already published. But, nevertheless, congratulation falls due to the Senior Institution for the part taken in assisting the movement to this end on behalf of the Manchester and District Junior Gas Association. But there is another stratum of workers attached to the industry that need, perhaps in some districts more than in others—sadly need we were almost saying—educating in all up-to-date methods of gas utilization; and those are the fitters employed by firms engaged in gas fitting and plumbing business outside the gas undertaking. Lamentable (more lamentable than ever in view of the expansion of fitting work in gas lighting, heating, and hot water supply) is the amount of ignorance that is found among them. Not long since an instance came under notice where a man was sent to fit up, in a private house, a pendant for a cluster of small inverted burners; and he left the whole of the latter without adjustment, simply through a want of knowledge as to the purpose of the gas-regulators. The Manchester Gas Institution have been taking steps in an effort to remedy this state of things in their area; and when they have got well on the way in the making of provision for this, they find failure in their precise purpose coming through the very men whose attendance is required at the classes being altogether indifferent. With men of this kind, there is a certain amount of pride that has to be tenderly handled. They want to know what the technical schools can do in teaching them the business in which they have been engaged both man and boy. They have to be shown that what is desired is to simply supplement the knowledge already possessed by information regarding modern developments. With the apprentice or the improver in gas-fitting work, the difficulty of getting hold of them for technical instruction is not so very great; but the immediate purpose is to attract the men who are doing the practical work of the day in this line. And the only way to get to them will be through their employers. Surely the masters must see that the greater the knowledge of their men, the better for the work that is undertaken; and it should be to their interest to give their men all the encouragement possible. Would not a conference with the master fitters enlist their aid in this matter? At any rate, if not already tried, it might be found to be productive of some good effect.

Then the Presidential Address with which Mr. Kendrick inaugurated his year of office in February is found to reflect many things that he has found useful in the conduct of the works under his charge, and the business confided to his care. They are the "wrinkles" drawn from personal and successful experience; and they are worth reading by those who missed them at the time of their publication. The discussion of the address at this meeting was somewhat disappointing. The speakers—and there were few of them—touched upon but one or two of the many matters that constitute the address. The most pertinent remarks were made on the subject of vertical retorts. There was the old complaint that there is as yet little published information that is definite regarding their capital, wear and tear, and renewal charges; and it seemed to one speaker that these costs would be greater than with horizontal and inclined retorts. It is extremely difficult for capital costs to be yet published in this country; and capital costs applying to one place and to one period are the most elusory things when places of other geographical position and when other periods are factors that come into play. As to wear and tear, the available information in this country, it must be confessed, is sparse; but from Germany we have had assurances of long life, and a condition in respect of wear and tear that compares favourably with horizontal and inclined retorts. In this matter, observation alone must disclose a condition that appears to be more favourable to vertical than to horizontal retorts. It is that the horizontal retort has to bear more strain than the vertical one, through having to carry the weight of the charges along the bottom; whereas the weight of the vertical charges do not come upon the retort itself, but is really borne by the lower part of the structure of the setting. After all, important as capital and wear and tear costs are, they cannot be the final consideration as to the financial advantage of one system over another. The final consideration must be looked for at the foot of a specially prepared balance-sheet. Coal and coke handling machinery costs more than barrows, shovels, and forks; but they are bought and installed. What for? Many initially expensive things are introduced into manufacture to produce economy or improved result which pays; and the information British engineers want is as to whether the ultimate result of adopting verticals will be in their favour as compared with horizontal retorts working in compliance with the most approved practices. In these and in many other ways, reflections of value are obtained from the meeting on Saturday week; and upon the meeting the President is to be congratulated.

The Relation of Percentage to Volume.

We have of late years been looking a little dubiously on the expression by chairmen at meetings of shareholders of the rate of increase of gas sales in terms of percentages rather than in volumes. Percentages are oftentimes misleading to the layman. To take a hypothetical illustration: Suppose a concern that twenty years ago had a consumption of 100 millions, and the rate of increase was then 5 per cent.; the business has grown meantime to 200 million cubic feet, and the increase is now at the rate of 2½ per cent. The old shareholder who does not look below the face representation of the figures jumps to the conclusion that the rate of increase in the business is on the decline, when his mind reverts from the 2½ per cent. increase of to-day to the 5 per cent. advances of twenty years and less ago; whereas the 5 per cent. of those times and the 2½ per cent. of the present day, under the circumstances named, have precisely the same value in volume.

To this matter we called attention in commenting on the affairs of the Imperial Continental Gas Association in May last. There had been a fractional reduction in the percentage rate of increase of consumption; and the Chairman (Mr. J. Horsley Palmer) had remarked upon it. It was then observed in the article in our columns: "We should like "Mr. Palmer to look at this matter of percentage increases "another way; and tell us what 5 per cent. increase in the "gas business represented in volume on the consumption of "ten and twenty years ago, as compared with that of to-day, "making allowance, of course, for the stations that have "been severed from the main body. The proprietors, we "rather think, would be very gratified with the result of "the exercise." And they were when the Chairman gave, at their meeting last Tuesday, the result of the investigation that had been made in compliance with the foregoing suggestion. His figures showed that twenty years ago a 5 per cent. increase (making the allowances suggested) meant in volume in a half year 198 million cubic feet; ten years ago, 244 millions; and in the second half of 1909, 279 millions. Now on these figures we contend that the statement as to the percentage increase does not, in view of the great divergence in the volume that a given percentage figure represents as compared with the past, do complete justice in interpreting business progress. As the progressive volume figures were read out by the Chairman representing the 5 per cent. increase at different periods, the proprietors at the meeting grasped their import and applauded. Nevertheless, Mr. Palmer is rather inclined to think that the volume figures have no interest, and that the tonnage of coal carbonized would appeal with greater effect to others than experts. We are not of that opinion. There are certain large companies with which one member of the Board of the Imperial Continental Association has acquaintance that have had considerable increases in gas made in recent times, with recession in the tonnage of coal carbonized. If the progress of these concerns was expressed in tons of coal carbonized, the proprietors might be pardoned for feeling a bit troubled. With all deference to Mr. Palmer, we still hold that to have increases of gas sales expressed in volume conveys more to the lay mind than either percentages of gas increase or tons of coal carbonized.

Radiators and Atmospheric Effects.

Some of the old forms of flueless gas radiators had, there is no question, a deservedly bad character; and this bad character seems to have left a sort of indelible impression upon the minds of the officials of the Home Office which they, with a consistency that acknowledges no possibility of progress and improvement, allow to still direct their judgment in regard to the effect of gas-radiators upon the atmosphere of workrooms and other places. To remove the false impression which tends to stifle progress in a useful application, under suitable conditions, of this form of gas heating, is work that lies immediately to hand; and undoubtedly the best procedure is to show that the new types of flueless gas radiator—gas-steam radiators confessedly stand far ahead of all forerunners—have not that noxious effect upon the atmosphere which official contumacy in refusing to recognize changed conditions and facts still ascribe to them. In view of this, what are the best steps to be taken? The answer is supplied in an article contributed to our pages this week by Mr. H. James Yates, of Birmingham, who has, in defence of this mode of gas heating and in the protection of his Company, been forced to take a prominent part in the endeavour to convince of error (it is only human under the circumstances, though perhaps not honest, to set one's back against any such convincing) the authorities concerned in the use of such heating arrangements in factories. In this work there has had to be a heavy amount of exploitation to produce evidence of an order satisfactory and of a weight sufficient to serve to rebut allegation; and it is from all this experience that Mr. Yates reduces, in the narrow compass of an article, the arguments and the advice as to what is necessary to prove to the authorities that the modern gas-steam radiator is more sinned against than sinning. The form that has been prepared, and which accompanies the article, showing all the particulars requisite in taking samples of air for analysis, has been gradually constructed from a considerable experience as to the points essential to the end in view. A contribution such as this one of Mr. Yates, dealing with a practical necessity in the cause of establishing public confidence and removing from the official mind the prejudices born in other days through the then existing inefficiency, is exceedingly serviceable and opportune in the interests of the whole gas industry.

Daylight Consumption.

Since Mr. W. J. Carpenter, of Great Yarmouth, called attention in the spring of last year, at the meeting of the Eastern Counties Association, to the fact that the growth of the daylight consumption in his supply area was, in certain months of the year, oscillating but little in the neighbourhood of 50 per cent. of the total output, many engineers have been interested to ascertain how they stand in the same respect; and not a few have found that their experience has quite a respectable resemblance with that of Great Yarmouth. Mr. Thomas Glover, of Norwich, in his Presidential Address to the Institution of Gas Engineers in 1909, attested to a movement in his own case towards an approximation with his not distant colleague's figures; and later in the year, in the discussion on Mr. Carpenter's paper, Mr. Paternoster showed that in certain months at Felixstowe he was, in the day percentage of output, running a neck-and-neck race with his Yarmouth friend. In the description of the Stretford Gas-Works published last week, it was seen that in that industrial area in the summer months the consumption, during the daylight hours, is all but balancing the consumption of the twelve hours from 6 p.m. to 6 a.m.; and in the winter the day figures are working up somewhat vigorously towards producing a balance. We think that, if Stretford would credit the summer with daylight beyond 6 p.m., the balance would be completely established. But there we have two eastern counties seaside resorts, a cathedral city, and an industrial area near Manchester all showing the same ascent of the output in the light hours of the day.

But the First Garden City—the product of seven years—issues a challenge on the figures for its last financial year to a pre-eminence in the matter of the day percentage of the total consumption. An article published elsewhere shows that about 60 per cent. of the consumption last year was accounted for during the hours of daylight. But the First Garden City is a residential place where the numerous workers in the factories that have settled there can go home to their midday meals; and of the consumers no less than 97 per cent. are furnished with cooking-stoves. Compare elsewhere this condition of things, as was done in the case of Stretford last week, with the consumption conditions that obtained in the daytime (say) twenty years ago. The change has been remarkable; but the alteration in the output of the daylight hours has worked its way into the gas business so gradually and easily that its full significance has not been appreciated in all quarters. It has an economic bearing of considerable importance; and one direction was pointed out by Mr. Stanley H. Jones in the address that he recently delivered to the Southern Junior Association (*ante*, p. 334), in mentioning that, through the change, the old accepted basis of the relationship (in the matter of provision) of gas storage to output is no longer necessary. In this and in several other directions—right along, for instance, to the consumers' meters—there is a marked capital economy in the tendency to equalization of the day and night output. Opposed to this economy is the increased capital expenditure demanded beyond the domestic meter by the daylight consumption. But it pays.

Further Gas-Power Economy only in Cheaper Gas.

If anyone seriously asked for justification for the series of lectures that are being delivered at the Manchester University, specially for juniors and learners of the gas industry, it would only be necessary to point to the character of the lectures and to the lecturers themselves for what was required. The lectures are of such a high order that they claim, and will obtain, a much larger audience than that immediately present before the lecturer. Mr. Dugald Clerk's deliverance last Saturday is an example; and we have no hesitation in saying that there are many gas engineers who will rise from the perusal of this plain digest of "The "Phenomena of Explosions in Gas and other Internal "Combustion Engines" much wiser than they were before. Only a physicist and chemist with a capacity for condensed statement could portray so concisely and so distinctly as Mr. Clerk has here done the many troublesome phenomena surrounding this subject, so as to be intelligible to the ordinary practical mind.

The phenomena of explosions in internal combustion engines are not of comparatively recent disclosure; but the fact remains that all the expenditure of time and talent with the view to their better understanding has left the scientific world in a state of inconclusiveness in regard to them. The gas-engine, like many other notable inventions, has moved along from stage to stage in success, with marked credit to the manufacturers, but without on their part any particularly great knowledge as to the governing science. But there, it has to be recognized, we have come to a pause, and further advances need the aid of science. This is why all (excepting probably a few who think they can get along very well without scientific help) interested in internal combustion engines welcome heartily the informative work of the British Association Committee on Gaseous Explosions. There is plenty of work for this Committee to prosecute in trying to replace the indefinite by the definite; and the extent of that work can be gathered by Mr. Clerk's statement of the practical points on which more accurate scientific knowledge is required. There is nothing really controversial about Saturday's lecture. The occasion was not one when controversial matters could be raised, in the absence of competent scientific critics.

But there will be one disappointment as the result of the lecture. Mr. Clerk still holds to the view that, in respect of the smaller types of gas-engine, in which town gas is used, there is little prospect of increasing the thermal efficiency. Indicated thermal efficiencies running up to, and in the neighbourhood of, 37 per cent. for 40-horse power engines, or thereabouts, are high; but the balance of the thermal value of the gas is also great. The longer the consideration Mr. Dugald Clerk gives to this balance, which must be largely, if not entirely, regarded as waste, the more confirmed he becomes in his opinion that further saving or economy would bear no equivalent to the heavy cost involved in realizing it. Therefore, if we accept Mr. Clerk's judgment as final, it amounts to this: That the means the town-gas industry can offer of producing power have attained the highest possible economical efficiency; and that this leaves but one open door to the reduction of the cost of gas power to the manufacturer, and that is the lowering of the price of gas. This view is expressed in Mr. Clerk's own words: "It would appear that the efforts of gas engineers

" to reduce the selling price of coal gas are more important " than those of the engine designer. There seems to be " more likelihood of reducing the cost of coal gas to the " power consumer by (say) 20 per cent. than there is of " increasing the brake efficiency of a coal-gas engine by this " amount."

Looking Forward at the Leeds University.

Special attention is asked to a letter in our "Correspondence" columns from Dr. William A. Bone, Livesey Professor and Head of the Department of Fuel and Gas Engineering at the Leeds University. It will be seen therefrom that to the juniors of the gas industry in the North, and to those elsewhere who can avail themselves of the privileges, is offered a most attractive programme in a series of 22 lectures, the delivery of which will commence on Jan. 11 next year. There is a current appropriateness about the subjects chosen for the lectures. In these days all technical juniors, and particularly those qualifying for, or holding, official position in the distribution department, should extend their knowledge to the utmost possible limits into the general subject of the distribution of gas, be in a position to bring knowledge as to gaseous combustion and the structure of flames to bear on their work, be thoroughly equipped with information as to the uses of coal gas for heating purposes, and be up-to-date in the science and art of both gas lighting and photometry. The men with knowledge on these subjects are the men who are best able to produce advances, and they too are the best qualified to carry the use of gas into places where gas has not been used before. When it is mentioned that the lecturers on the subjects named are Professor Arthur Smithells, Dr. W. A. Bone, Mr. Walter Hole, Mr. John Bond, and Mr. Jacques Abady, there is no need to allocate subject to lecturer. Every name stands high as that of a specialist in one or other of the subjects mentioned. Mr. Ernest Bury is also delivering a course of eight lectures on Bye-Product Coking Processes; and the plans are already being formulated for more distant dates, in which plans Dr. Colman is included. It will be seen that the Leeds University is bringing around its new department some of the most accomplished men in the laws and principles governing certain branches of the industry's work. We hope that what is being done will be rewarded in a manner that will give the fullest encouragement for the future; and that manner is the one set forth in the last half-a-dozen lines of Dr. Bone's letter.

High-Pressure Mantle Renewals.

There is a very useful letter in our "Correspondence" columns this week, for which we are indebted to Mr. E. R. H. Wingfield, the Chief Inspector of the Brentford Gas Company. The Electrical Press has a bad habit of dealing largely in assumption; and among their assumptions is one that high-pressure inverted gas-lamps are costly in the matter of mantle maintenance. Their hypotheses in this respect are as remarkable as they are varied; and use is made of them by electrical engineers when pressed into a tight corner by high-pressure gas-lamps. The experience Mr. Wingfield relates refers to the 309 lamps in the grounds of the Japan-British Exhibition, where they were exposed to the extremes of weather of the past six months. The details he gives show that these 309 lamps only demanded an average of 1·87 mantles per lamp over the six months' run of the exhibition; and this though no mantle was allowed to remain in position after it indicated the least sign of deterioration. We remember that Mr. Alex. A. Johnston, the Chief Engineer of the Brentford Gas Company, told us, that when the lamps were being overhauled in preparation for the exhibition of 1909, the mantles that had been left in the lamps during the whole of the winter succeeding the Franco-British Exhibition were found to be intact. Compare Mr. Wingfield's experience with the erratic life of metallic filament lamps as given, on electrical authority, in the "Electricity Supply Memoranda" for Oct. 11.

Centrally Suspended Gas-Lamps.

Quoth the electrical press (thereby confessing to their belief in very narrow limits being applied to the art of engineering) "it cannot be done," when the simple, though not universally approved, proposition was made that there should be a trial of central suspended high-pressure gas-lamps in the City of London, after the fashion of the centrally suspended electric flame arcs. It has now been done, and the electrical prophets have retired without a word of admiration for those who have shown that what was electrically believed to be impossible has been quite possible through gas ability. The suspended trial lamps at the London Bridge end of Cannon Street are of Keith's standard pattern high-pressure inverted type. There are two lamps on columns similar to those that are being fixed in the West-end. The centrally-suspended ones are each fitted with two 1000-candle power burners. They are supported on strong steel wire ropes (on which a small carriage runs) attached to the buildings on each side of the street. The gas supply is taken to the lamp by means of flexible tubing, in turn supported by a second wire. Normally, of course, the lamps are suspended centrally over the street; but by a special arrangement of wires, pulleys, and winch, they can be drawn to the side, and there lowered to the pavement level for easy maintenance. The gas supply is always connected; this being very desirable with gas-lamps in order that they may be adjusted, and everything seen in proper working order before being again raised and transferred to their aërial position centrally over the roadway. When in proper position over the street, the weight of the lamp is taken off the wires attached to the winch, and supported by a special safety-catch arranged in the carriage running on the main wire.

Retribution at Hastings.

We have often had a tilt at the Hastings Town Council over their extraordinary conduct of the electric supply undertaking, over their aggressive attitude towards the Hastings Gas Company, and lastly and more recently over their hostility to the Standard Burner Bills. For this occasion, we must suspend stricture and adverse comment, and adopt an attitude of the profoundest sympathy, with perhaps just a little contempt underlying it for the narrow-minded and revengeful spirit in which the Council entered into the opposition of the Standard Burner Bills on the Gas Company uniting in the promotion. The Council set their own ignorance in regard to this matter above all the investigation—scientific and parliamentary—there had already been into it, and seemed glad to have any opportunity of making an attempt to score against the Gas Company. The attempt has been an ignominious failure; and the Council feel they have been sold. The bill of expenses has been sent in; and it is sufficient to say that the Town Clerk when he saw the amount at the foot was staggered. As a rule, it requires something of a very potent nature to stagger a Town Clerk; but the Hastings Town Clerk (unaccountably there is some pleasure in dwelling upon the fact) was staggered by this particular bill. Complaint was made at the Council meeting last week as to the amount of the account; but it was felt that the only course was to pay it, and let the affair be buried among the things that are best forgotten. But some of the ratepayers appear to be taking a very live interest in questions that at one time they allowed to slide along without much heed. The ward elections have been proceeding; and in one ward the opposition to the Standard Burner Bill was one of the strong points. In that ward the Chairman of the Public Lighting Committee was rejected! In another ward, the electric light business was made a test point The Electricity Committee have lost their Chairman! If this is the gentleman who at one time thought electricity could be generated almost for nothing for public lighting, but could not be for the private consumers—well, perhaps rejection may be taken as a providential intervention in the interests of the borough!

Ventilation and Lighting.

The Reading Electric Supply Company is one of those concerns that has to meet the competition of a progressive Gas Company very much alive in its commercial methods; and good fortune does not in consequence seem to run very much in the way of the electrical undertaking. In an advertisement, the Electricity Company recently tried to score off one of the Directors of the Gas Company—Dr. Jamieson B. Hurry, who some time ago, in a contribution to the "British Medical Journal," stated that: "An ill-ventilated gas-lit office may so depress the heart, even when organically sound, that the pulse becomes feeble and intermittent and life miserable and useless; the heart and general health depressing each other. Removal of the exciting cause may in itself ensure recovery." The Electricity Company

happened across this statement, and made use of it in one of its advertisements in a local paper. Whereupon Dr. Hurry wrote a letter to the local paper, in the course of which he remarks: "To anyone familiar with the overwhelming influence of adequate ventilation on health, it will be obvious that want of ventilation in any office is highly prejudicial, and that what was said would apply, *cæteris paribus*, to an ill-ventilated office even if lit by the electric light. Indeed, much evidence has lately been adduced to show that gas is more useful than the electric light in promoting efficient circulation of air. It is for this among other reasons that gas is being frequently substituted for the electric light. The latest example is perhaps the Society of Medical Officers of Health, which has recently installed gas on its premises, after previous experience with the electric light." A reference to what has been done at the headquarters of the Society mentioned appears in our "Electricity Supply Memoranda" to-day; and a full description of the gas lighting and heating installation there will be found in the "JOURNAL" for Oct. 18, pp. 179, 186.

The Cement Market.

The welcome news of an improved outlook in the cement market is chronicled by the "Financial Times" in an article contributed by an expert correspondent, who says there has been some marked revival of interest the past few days in the demand for cement securities, and particularly in the capital issues of the Associated Company, which have been heavily dealt in, with the result that they have undergone substantial appreciation. To account for this, the market has fallen back on the usual talk about a combination with Continental producers; but though this theory is generally accepted as being adequate, it has, in the opinion of the writer of the article, really little to do with the present activity in the share market. Buying of cement securities is, he says, due to influences which are of a general and, it is believed, more permanent character than any trade amalgamation, which, as history shows, is always liable to break down. That is to say, the rise in cement securities is almost entirely attributable to the advance which has taken place in the quotations for cement itself; while this latter movement arises from the increased trade demand. Consumption, he argues, is at present fully up to the supply, if not ahead of it; while the companies have no reserve supplies to fall back upon. Though there are no signs of any slackening demand at present, it is pointed out that it will be better, in considering this factor, to be guided by precedent; and under ordinary circumstances there should be a decline in consumption during the next three or four months. But should this prove to be the case, the producing companies will still have as much as they can do to fill the contracts already on hand; while should circumstances permit of the turning out of any surplus stock, advantage will be taken of the opportunity to prepare for what is believed will prove to be an increased volume of business next spring. The statement of the position here set forth will doubtless be regarded as good news in many quarters; and additional comfort is to be found in the assertion that the contracts now being fulfilled are of a nature that may be regarded as permanent—that is to say, there has been a considerable accession of business from quarters which have not hitherto relied to any appreciable extent upon cement for the carrying on of their operations.

Mr. H. W. B. Cotterill, Assoc.M.Inst.C.E., has been appointed Resident Engineer for the new reservoir works which are being carried out by the Cardiff Corporation. Mr. Cotterill was a successful student in the Engineering Department of what is now the University of Sheffield, and was articled to Mr. E. M. Eaton, M.Inst.C.E., Consulting Engineer to the Sheffield Corporation. For nearly ten years he was an assistant on the engineering staff of the Little Don Valley works; being chief assistant to the Engineer, Mr. William Watts, M.Inst.C.E., on the Langsett reservoir for the last three years of that period. After leaving Sheffield, he was for a short time an assistant to the Water Engineer of Cardiff (Mr. C. H. Priestley, M.Inst.C.E.), and left that appointment to take charge of the scheme for the improvement of the water supply of Blaenavon. In September, 1908, he returned to Cardiff; and since that time he has been in charge, under the Water Engineer, of the preliminary work for the new undertaking. The contract for the first portion has been let for £201,000; and Mr. Cotterill was unanimously appointed Resident Engineer in connection with it, on the recommendation of Mr. Priestley.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 420.)

CONSOLS were again the focus of attraction or attention last week. But whereas the previous week they were shrouded in the deepest gloom, last week they emerged from the clouds; and if they did not quite shed a radiance around, they were at any rate a bright spot in themselves. True, they have not yet fully recovered their lost ground; but it may fairly be hoped they are on the road to it. Thus encouraged, the Exchange had a more cheerful appearance, and business was better generally. Monday was rather inactive in view of the Exchange being closed the next day, and many markets were listless; but Government issues were supported. On Wednesday, markets were some little time getting into swing; but the tone was quite promising. Gilt-edged issues were in demand, and Consols rose ¼ for the account. Railways advanced here and there, and Americans entered on an upward course. On Thursday, the cheerful disposition was more pronounced. The gilt-edged class were well supported, and prices advanced. Consols gained another ¼ for money and for the account. Railways were a shade better; and the Foreign and American Markets were firm. South Africans, however, gave way. On Friday, the bright tendency was well maintained, and the demand for Consols and the choicest quality was marked. Railways were rather uneasy over labour questions; but the advance of Americans progressed. Saturday was a quiet day. Consols were firm and unchanged; and the general tone was very good. In the Money Market, there was scarcely any movement at first; but in the latter half of the week rates grew harder. Business in the Gas Market was quite on a normal scale of magnitude; but it was devoid of any marked feature, and there were but few changes in the quotations. In Gaslight and Coke issues, the ordinary was fairly busy, and was very steady; all transactions being within the narrow limits of 104⅜ and 105¼. The secured issues also were busy and unchanged; the maximum marking from 87½ to 88⅛, the preference from 103 to 103⅜, and the debenture from 80⅜ to 81⅛. Very little was done in South Metropolitan, and the price was firm at from 121 to 122½. The debenture realized 80⅜ and 81¼. In Commercials, the 4 per cent. changed hands at 106⅛ and 107, and the 3½ per cent. at 102. Among the Suburban and Provincial group, Alliance and Dublin was done at 89½ (a rise of 1), ditto debenture at 96¾, British at from 44¼ to 44⅞, and Ilford debenture at 98 and 98¼. On the local Exchange, Liverpool "B" was done at 164—a rise of 1. In the Continental companies, Imperial was rather inactive but firm; prices advancing from 187½ to 189⅜—a rise of 1. European fully-paid marked from 23⅜ to 24⅛ (a fall of ¼), and ditto part-paid from 17⅞ to 18⅛. Union was upset by an unsatisfactory dividend announcement. One transaction was done at 85, and another at 90; the quotation being nominally 80-100. Among the undertakings of the remoter world, Bombay marked 6¼, Buenos Ayres debenture 97¼, Cape Town debenture 89½ and 90, Monte Video 12¾, Oriental 140, Primitiva from 7 9/32 to 7 7/16, ditto preference from 5 3/16 to 5 5/16, ditto debenture 98⅛, and River Plate debenture 98¼.

ELECTRICITY SUPPLY MEMORANDA.

The Despotism of Municipal Ownership—"Electrician" Catching at Straws—Anguish—A Misinformed Local "Guardian"—Is it a Bait?—The Answer of Outside Experience—Prices and Other Points.

IT is a matter for regret that the Electrical Press should take so much to heart the successes of gas in street lighting. It should be recognized that the gas industry has a very serious fight in front of it, with the majority of electricity undertakings in the country in the hands of municipal authorities who are also the road-lighting authorities. Through this circumstance the gas industry is not receiving fair play, nor is the public lighting being treated on those business principles that obtain when competition has not the weight of municipal possession thrown upon one side only. Under such conditions just treatment for private enterprise, and a frank consideration of the position between the rivals, are difficult to obtain. In some cases, the management of the public lighting is placed in the hands of the Electricity Committee; and the difficulties of private enterprise are then made greater. It is so at Croydon; and there the lamps in another eight roads are to be converted from gas to electricity. Financial and efficiency questions matter little. The Electricity Committee determine; and the Town Council bows its head in silent compliance without venturing to give the matter the judicial consideration that, as representatives of the ratepayers, and not the puppets of the Electricity Committee, they should bestow upon this public service. The Committee have shown that they are the heads of the Council, and not the Council the heads of the Committee. The Committee are autocrats of the first water. They intend to both propose and dispose; and their appearance before the Council in this matter is only a necessary formality. The Committee have made up their minds for the future. "In many streets," says Alderman Miller, the Chairman, "electric cables are lying idle, so far as public lighting is concerned; and in these the Committee propose from time to time to make the change

to electricity." That is their manner of proceeding. The Town Council have not perhaps heard of the serviceable rule laid down by Mr. H. Ross Hooper, of the Local Government Board, that "no change should be made in the system of lighting purely out of feelings of sympathy."

Poor "Electrician!" How terribly it is upset by the march of gas in public lighting; and what foolish things it is led to say by trying to evade facts, and relying for support for its attitude upon every straw that the wind happens to carry its way. The leader columns of the "JOURNAL" recently contained an article on the subject of inverted gas-burners; and it will be remembered that a certain respected firm read into what was said much more than the words gave them warrant for doing. In the course of a letter received from that firm, the remark was made that the inverted burner "throws a powerful light on a restricted surface immediately beneath the burner itself, leaving the rest of the room in comparative gloom." The "Electrician" gleefully hugs this statement, and commiserates with "Poor Westminster!" Is the staff of the "Electrician" so heavily pressed hunting for straws that time cannot be spared to run along to Westminster one evening, and have a look at Victoria Street, Vauxhall Bridge Road, and the streets at the back of the Tate Gallery, in Ashley Gardens, and elsewhere, to ascertain the truth on their own behalf? In the streets named, they will readily obtain a view of high-pressure lighting by inverted lamps of 1800-candle power, and of two forms of low-pressure inverted lamps. There would be some sense in doing this, but their present action comes within a category that is diametrically opposed to sense. Glad enough is the "Electrician" (and we since see the same is the case with the "Electrical Times") to find someone saying something about light concentration in which gas is concerned. To have the rival suffering from the old bad complaint of electric lamps is just what is wanted by electricians so as to have the lights in the matter of diffusion placed on equal terms. But it is better to go and see the actual state of things, than expose ignorance by adopting other people's views.

There is also great anguish of soul displayed in the electrical papers over the adoption of gas for lighting and heating in the meeting and demonstration rooms at the headquarters of the Society of Medical Officers of Health. Our electrical contemporaries want to limit the installation to as narrow a point as possible. They smile at the idea of gas lighting being adopted in the meeting room and electric fans being used. But it is quite clear they do not understand the position. The Electricity Publicity Committee suggests the use of fans where electricity is used for lighting for keeping the house healthy; and verily the advice is greatly needed. But in the meeting room of the Society of Medical Officers the electric fans are not required because gas has been adopted for lighting, for the lamp is a self-ventilating one, and nothing can pass from it into the air of the room. The fans are used for drawing air in from the exterior of the building when a meeting is going on, passing the air through filtering material, over radiators heated by hot water supplied from gas-boilers, and then into the room; a third fan being employed on the other side as an extractor. If further warmth is wanted, an ordinary gas-fire is in readiness for duty. But in the two demonstration rooms inverted gas-burners have been installed; and no electric fans are used there for ventilating purposes. Thus the three rooms that are in greatest use when the meetings are being held at headquarters, are now illuminated by gas, and gas is the fuel used for heating the rooms. From these plain facts all the verbosity of the Electrical Press cannot detract in any way.

Local papers have great influence in swaying public opinion within the area of their circulation; and, that being so, there should be in them as little show of partisanship as possible, unless there is very positive proof that there can be substantiation and sound defence. In the controversy between gas and electricity, the local papers are taking a large part; but there are few that have adopted the such distinctly partisan attitude as the "Sheerness Guardian"—so partisan and dogmatic, in fact, that what is written will no doubt be viewed, and properly, with the deepest suspicion. The "campaign" opened in the town by the Sheerness and District Electric Power and Traction Company (which is one of those titles with a fullness that ill-fits the small character of the business done by the concern) offering to convert 75 incandescent gas-lamps to metallic filaments at a cut price. Then the services of the "Guardian" were enlisted—a paper, for aught we know, that may be owned by someone with an interest in the Electric Power Company, and possibly, too, the someone may be a member of the District Council. Anyway, the character of a three-column article in the "Guardian," with electrical inspiration and colouring in almost every line, is such that one might be excused the impression that the paper had passed over into the possession of the Electric Power Company, lock, stock, and barrel. Now let us tell the gentleman who is responsible for the article in question, that the "Guardian" office is not the only fount of knowledge on this particular subject of Gas *v.* Electric Lighting, that Sheerness is not the only place of note on the face of the globe, and that experience of a pretty large order has been gathered outside that town. Now, Mr. Editor, do not raise any protest against the suggestion as to contracted vision on your part; your own article is condemnatory in view of the existence of an overwhelming experience attesting that many of your statements are altogether truthless if intended to have common application. If that is declared not to be the intention, then it will clearly be an admission that what is done elsewhere with modern incandescent gas-burners can be done in Sheerness.

Before we go any further, it may be suggested to the District Council that this offer regarding the conversion of 75 public gas-lamps may be nothing but a sprat to catch a mackerel. It may, in fact, be simply the first move towards trying to get the Council to purchase the concern. This is only surmise; but if it be true—well, we suppose the business men on the Council will take good care to look carefully into the value of the property (track, rolling stock, lighting business, and prospects) before they land upon the ratepayers a property that it may not be to their advantage to possess. We reiterate that it is not known that this is the ulterior motive of the Company in trying, through the public lighting, to get the Council into closer relationship with themselves; but we say it is possible. However, as to the offer for the conversion of 75 public lamps to electricity, it is hoped the Council will not do anything hastily; and that before making any change they will give the Gas Company an opportunity of making an offer and display of modern lamps—say, of the inverted order, such as are going into the streets of Westminster, Hackney, Bethnal Green, Finsbury, and Stoke Newington. In Westminster alone over 7000 inverted gas-burners have just been put into the street lamps. Is this incorrect, Mr. "Guardian"?; and does it bear out the assertion that London is returning to electricity? The answer will doubtless be that in Marylebone, Hampstead, and Shoreditch the streets are being fitted by electric lamps, to which we retort that these are areas in which municipal trading in electricity has been carried to such a point that the cheaper illumination offered by the Gas Company has been brushed aside, in order that the Councils may, as they put it with faltering tongue in dragging local government down to such a poor level of excuse, patronize "their own shop."

But as to the Sheerness offer for the conversion of the 75 lamps. The bait has been well chosen. The "Guardian" claims that there will be a saving of 15s. 4d. per lamp per annum if it is accepted. There will be nothing of the kind. The Council are to pay for the running of a special cable and make the conversion at a cost of £287 10s.; and there is also a suggestion as to other additional expense—all representing outlay exceeding the stated annual cost. The offer excludes lighting and extinguishing, includes the maintenance of lamps, but not lanterns and columns. Under these conditions, the annual cost of the 75 lamps of 50-candle power (the Editor of the "Guardian" assures this is British candle power, and not Hefner units—we should like the name of the lamps), lighted from a quarter of an hour after sunset to 1 a.m., is £1 5s. 8d., and for 100-candle power lamps £2 2s. 7d. If the 50-candle power lamps run from dusk to dawn, the charge is proposed of £2 2s. per lamp per annum, and for 100-candle power lamps £3 13s. Now the average cost of the incandescent gas-lamps is said to be, in the article in question, £2 1s.; the Secretary and General Manager of the Sheppey Gas Company (Mr. H. Barber) states that the price is £1 18s. 7d. This is for 80-candle power lamps compared with the 50-candle power ones offered by the Electric Company. But the writer of the article in the local paper doubts this statement as to the candle power of the incandescent burner. He speaks about some doubtless highly respectable gentlemen who have been using their eyes in making illumination tests by studying wall surfaces and reading newspapers near the lamps. Highly amusing is all the puerile and empiric writing that is presented in the three columns. There is much talk of fractured mantles, and of depreciating illuminating power with mantles. If all that is said is true, then the lanterns of Sheerness must be in bad order, and the maintenance not what it should be. If the lamps are properly looked after—and that is not a heavy task—those of the inverted type should give 20 to 25 candle power, while the upright ones should afford 15 to 18 candle power, per cubic foot of gas consumed. Opposed to all the frothy statements in the local newspaper stands the fact that the Gaslight and Coke Company are under a penalty in Westminster of 5s. per lamp per night for any infraction of their contract illuminating power. How are they able to do this if the assertions of the "Sheerness Guardian" are true, and have common application? The fact of the matter is that the writer of the article has been labouring under excessive partisan zeal, or accepting information without having the technical knowledge to put it to the test, and so has let himself slip altogether from a common-sense position. While he is explaining his attitude in this matter, perhaps from the big store of assumed knowledge he will tell us why competitive experiments in Victoria Street (Westminster), Beckenham, Bradford, and elsewhere have bestowed the laurel and public lighting contracts on gas in preference to electric lighting? "Electric light throws its beams the farthest." Really! Is that why electric light did not succeed in the competitive trials referred to, or because the statement made by the "Guardian" is an inversion of the truth?

We have suggested that the offer of the Electric Light Company is a bait to the local Council, though when all charges are thrown in, they will find their outlay is a fairly expensive matter. Calculating out the prices proposed for current and lamp maintenance to a "per unit" basis, it is found that, as there are 2173 lighting hours in a year from dusk to 1 a.m., the charge for the 50-candle power lamps is equal to 2d. per unit, and for the 100-candle power lamps 1·6d. per unit; and regarding the all-night lighting (4327 hours per annum) the charge is equal to, for the 50-candle power lamps, 1·8d. per unit, and for the 100-candle power lamps 1·6d. per unit. If the people of Sheerness have an opportunity of

seeing these figures, they will observe that they are not by any means those that they are called upon to pay privately for electric current. The local paper publishes some rubbish about a local consumer who gives an "interesting comparison from his own experience," whereby a "32-candle" incandescent gas-lamp costs 1d. per four-and-a-half-hours' use, whereas a 32-candle power electric metallic filament lamp costs 1d. for 5¼ hours. Did that consumer photometrically measure the lamps? Now let us see. Will our local journalistic friend deny that a 50-candle power inverted gas-lamp can be run on 2½ cubic feet of gas per hour; while in some places 2 feet will suffice? If he does, there are plenty of places where proof can be offered to him if he knows how to read a photometer and test gas-meter; and, of course, a man with so much knowledge, and with the power of dogmatic assertion so fully developed, will not deny his ability to read a photometer. With gas selling at 3s. 2d. per 1000 cubic feet, 1d. will purchase 26 cubic feet. Is that true, Mr. "Guardian"? And dividing 26 cubic feet by 2½ cubic feet, it is seen that a 50-candle power inverted gas-lamp can be run on a pennyworth of gas, at the price named, for 10·4 hours. Is there anything wrong with that? Or take the slot-meter price of 3s. 10d., the hours work out to eight-and-a-half for 1d.; while with electricity at 4d. per unit (we do not know the flat-rate in Sheerness) a 50-candle power metallic filament lamp on a pennyworth of electricity will only run for some four hours. Is there anything wrong with that, misleading and misnamed "Guardian"?

There is more in the article we should like to tackle, but have already devoted to it more attention than it is really worth. But there is one point. It was properly suggested that a breakdown of the electricity supply would put the streets in darkness where conversion had taken place; whereupon the electrically well-informed man wrote: "The likelihood of such a thing happening is extremely remote, and not more to be feared than the blowing up of a gasometer [*sic*] or the bursting of the principal gas-main into the town." Records show no less than 25 failures in electricity supply areas last year. The "Guardian" writer can perhaps tell us how many holders and leading gas-mains in this country blew up or burst in the same period. As there are already so many matters for the learned writer to corroborate or reply to, we had better now stay our hand.

FROM VIRGIN SOIL.

Lighting, Power, and Water Supply at First Garden City.

STANDING on rising ground in First Garden City (known under the more formal style of Letchworth), and looking round on the picturesque scenes—produced by the combination of Nature's handwork, and of the skill and art of the surveyor, the architect, and the builder—one is struck by the beauty that abounds in whichever direction one gazes. All the houses have a touch of old English character about them. Nestling among trees on the well-wooded slopes of the 3818 acres comprising the estate, are the houses of those well favoured in the things that go to make life pleasant; in broad avenues elsewhere are seen the houses, with ample space about them, of the middle classes; and in a section of the district near the factory area are pretty and well-kept houses for the families of artizans employed in the industries that have been planted in the place. There are the factories, too, designed to be in keeping with the surroundings—an object-lesson to all that it is not necessary that factories should be externally smoke-begrimed and ugly, that it is a mistake to suppose that cleanliness and a pleasing environment are incompatible with practicality and utility, and that they err who fancy the worker should be condemned, in order to get the best work out of him, to dwell and labour in surroundings against which life—life in its fullest sense and meaning, life most in accord with Nature's law—rebels. As survey is made of what has been accomplished here in the short space of a septennium, it all seems impossible that this was virgin soil at the beginning of the period, and that a town on novel lines—conceived, planned, and developed to such a degree—could by this time have been brought to such a state of self-contained perfection. As the writer surveys the varied and picturesque scene, the Resident Engineer (Mr. A. W. E. Bullmore) remarks that, when the area was acquired to give effect to the ambitious scheme of its promoters, it embraced the villages of Norton and Letchworth, and part of the village of Willian; and the population was then not more than 400. To-day, there are between 1300 and 1400 houses in First Garden City, including shops and public buildings; and, in addition, 29 factories and workshops. And he adds that not a single manufacturer who has established himself there with his workpeople has gone away; on the contrary, the tendency is for the manufacturers to extend their buildings and increase the number of their workpeople. The population by the way is to-day estimated at about 7000.

THE DEVELOPMENT OF THE GAS-WORKS AND BUSINESS.

The evolution of this Garden City scheme from conception to present material presentment has been a matter of considerable interest. There is an air of completeness in every detail—including the provision of the gas, electricity, and water supply. We have had something to say about these services on previous occasions—the last time on Nov. 26, 1907; but there have been wonderful developments since in the businesses which had to start on most speculative terms. It is easy to make provision for such services when there are certain existing facts to form some sort of guide; but in First Garden City there was nothing of the kind. No one could predict whether this or that would happen; whether success or failure was to be the fate of the what some people chose to refer to, with more or less covert contempt, as Utopian. Success has been the result; and success has been built up at such a pace that there has been nothing to do but spend, spend, spend to keep in line with it. But there is no help for this sort of thing in such unique circumstances. What it means is that profitable business (calling for capital expenditure somewhat frequently) is being built up more rapidly than could have been anticipated; but all the better will this be when a period of more settled conditions follows the years of initial and constructive work. Fortunately, in connection with the gas-works, a Gas Engineeer (Mr. Charles Hunt) was appointed, who has taken quite a paternal interest in the development *ab initio* of the gas supply for a town then unmade and for a community then scattered we know not where. He chose a site from the virgin acres that would admit of considerable works extension if needed; and on it he placed a plant (which was set to work in 1905) equal to 6 million cubic feet production per annum, and capable of step-by-step expansion. But it was not long—barely two years—before necessity claimed an ascent to 20 million cubic feet productive capacity; and now the works are just emerging from further additions that bring the annual productive capacity to 70 million cubic feet, or thereabouts.

TOTAL AND DAYLIGHT GAS CONSUMPTION.

This is not surprising when building and population development is considered; and the chances are that there will be a considerable immediate increase in both lines of development in view of factory extension, and the increase in workers that will be brought into the area. If we exclude the remote villages, it may be said that practically every householder in Letchworth is a gas consumer—certainly 99 per cent. of them are, and 97 per cent. have cooking-stoves. Remember that in 1904, there were no gas-works here; and there were barely any houses that required a gas supply. By the end of September, 1909, there were 1168 consumers—499 ordinary, 662 prepayment, and 7 with gas-engines; and on Sept. 30 this year, these figures had advanced to 1236 consumers—530 ordinary, 699 prepayment, with still 7 gas-engines. The yearly advance of gas consumption is peculiarly interesting. From the commencement of business in 1905 to Sept. 30, 1906, the consumption was 5 million cubic feet; in the year ending Sept. 30, 1907, 17½ millions; Sept. 30, 1908, 22 millions; Sept. 30, 1909, 26 millions; Sept. 30, 1910, 31 millions. But a curious thing is the growth year by year in the proportion of daylight consumption to the total. In the first twelve months (or rather more) to Sept. 30, 1906, the daylight consumption was equal to 4 million cubic feet; to Sept. 30, 1907, it was 7½ million cubic feet; 1908, 12 million cubic feet; 1909, 15 million cubic feet; 1910, 19 million cubic feet. When it is borne in mind that 97 per cent. of the consumers in Letchworth proper use cooking-stoves, that there are seven gas-engines in use, that printing works employ gas in the daylight hours for melting the metal for their Linotype machines, and other works employ bunsen burners for various other operations in which heat is required—the reason for such a relatively large daylight consumption is easily explained. But taking the proportion that was sent out in the daylight hours during the past financial year, to Sept. 30, it is seen that it is about 60 per cent. of the total output. We rather fancy such a percentage of daylight output over a year is rather unusual. One or two other particulars about distribution and business expansion are that, when the works first started, the mains laid equalled 4 miles, while to-day there are about 13½ miles of mains, to which there are also connected 140 public lamps, all fitted with incandescent gas-burners. The price charged for gas for domestic purposes is 3s. per 1000 cubic feet net; while a sliding-scale for power is applied ranging from 3s. to 2s., according to quantity consumed.

THE EXTENSIONS AT THE WORKS.

There is no necessity to again describe the gas-works, which are a model of economical construction for a plant of moderate output; and the original plans of Mr. Hunt provided for extension, in view of the future being an entirely unknown quantity, on most economical and easy lines. The retort-house has been extended, so that it is exactly double the length that it was before. This work has been executed by Messrs. Davies, Ball, and Co., of Letchworth, who, as a matter of fact, have been responsible for all the building in connection with the extensions. Originally, the house started with a bed of three retorts, and one of five. These two beds had to be converted to one of six and one of seven retorts. Two more beds of sixes were put in; and these in turn were converted to beds of sevens. The retorts are 18 in. by 15 in. Ω section, and 9 ft. long. In the new bench there are four settings of eight retorts, 21 in. by 15 in. by 9 ft. long. Messrs. F. C. Sugden and Co. are the contractors for the retort-settings and all their mountings. The productive capacity of the old portion of the house is about 150,000 cubic feet, while that of the new portion is at least 200,000 cubic feet; so that the house is now equal to a daily output of 350,000 cubic feet. There is nothing special to describe about the new settings, beyond saying that they are a form of Klönne settings, with Hudson producers. In the old settings, there has never been the slightest trouble with the heats; and using second-class Derbyshire coals, 10,500 cubic feet of gas are at present produced from them per ton. But with the new

settings, it is believed that a higher result will be achieved. The new bench has had a tar-tower applied; and the idea has been adhered to by Mr. Hunt of carrying the foul main inside the house as far as possible. Only once has there been trouble with naphthalene; and that was on an isolated occasion at one of the gas-holder outlets. There has never been any sign of naphthalene on the district; and therefore, there is no disposition to depart from the plan of keeping the foul main as far as possible inside the retort-house, as has been the case from the first. The yard connections have been increased from 8 to 10 inches.

Then new exhauster and boiler houses have been built. These are each 30 ft. by 20 ft. The exhauster-house walls are lined with enamelled white-faced bricks, with a dado of green-faced bricks; the floor being red tiled. The whole makes an excellent finish. In this house is a single set exhauster of 20,000 cubic feet per hour by Messrs. R. & J. Dempster, Limited, and already a bed has been provided for a second set when requirement demands. In the boiler-house is found a boiler, 5 ft. 6 in. by 18 ft., by Mr. John Thomson, of Wolverhampton; and by its side, is space for another when needed. But we take it this boiler will suffice in the matter of steam provision for some time to come. Among other additions is a Livesey washer, by Messrs. Westwood and Wrights, and a Holmes scrubber-washer.

It is seen that there is ample room on the site for future extensions. Work that is also now proceeding and forming part of the present scheme, is the alteration of the railway sidings, and the installation of new condensers. The four 8-feet square existing purifiers will no longer answer all the needs, and a set of four 12-feet square boxes are about to be laid down. In connection with them Messrs. Morris and Bastard's runway will be used for dealing with the purifying material. The gasholder capacity has also been extended from time to time until now there are two two-lift holders, having a combined capacity of 150,000 cubic feet. These holders and the extensions were the work of Messrs. Westwood and Wrights. Other additions include a new station meter by Messrs. Parkinson and W. & B. Cowan, as well as a 12-inch governor by them, supplementing the old 6-inch one.

Reserve Fund for Repairs, Maintenance, and Renewals

In an undertaking of this kind, with small beginnings and an unknown future, it was an excellent thing the First Garden City were well advised. For in such a scheme as this, with nothing to guide, there was the opportunity for profuse extravagance. Not only the larger financial considerations, but the smaller ones, were carefully weighed by Mr. Hunt. On his advice, there is an innovation in the matter of a reserve for repairs, maintenance, and renewals, which it would be well, for the equalization of these charges year by year, if other concerns could adopt, just as the First Garden City, have been able to do, being altogether unfettered by parliamentary ordinances of any kind in relation to their gas, water, and electricity supplies. Mr. Hunt's proposal (which was accepted as sound and protective) was that, from the outset of the undertaking, there should be set aside out of the profits of the year a sum equal to 5d. (later increased to 6d.) per 1000 cubic feet of gas sold per annum as a repairs, maintenance, and renewals fund, to be drawn upon every year for repairs and renewals and upkeep generally—the surpluses being allowed to accumulate. When, for instance, plant of any kind is done away with, it is credited to capital, and charged to this fund. After charging the fund with repairs, maintenance, and renewals for the last financial year, the balance was £744. The same plan, it will be seen later, has been applied to the water undertaking. There is no doubt that the principle of this reserve is right—a *pro ratâ* charge being made on a basis that has the merit of uniformity over the business year by year, and so constituting repairs, maintenance, and renewals a uniform charge, and not an erratic one, year by year. There is the element of fairness about this that makes it commendable.

A Well-Known Firm Transferring its Manufactory.

Mention has been made of the number of factories that have been established at First Garden City—factories that are extensive and factories with world-famed names along the tops of the façades of the premises. Who in the gas industry is not acquainted with the name of Messrs. Ewart and Sons, Limited? Ewart's gas geysers are known far and wide; and the firm are going to transfer to Garden City a large part of their manufacturing work in this line, together with their employees. For the purpose of the erection of the factory, some 3 acres of land have been taken close to the gas-works; and the new premises will occupy a superficial area of about an acre. It is expected that the firm will employ some 300 men here, and will be good patrons of both the gas and electricity undertakings. The workmen, too, will be wanting gas in their homes.

The Electricity Power Station.

Speaking of the electricity power station, a few words should be said about the extensions there, as they show there is scope for both gas and electricity services in a self-contained community such as we have in this First Garden City. There is no denying the fact that for certain purposes—particularly for intermittent work, and not long runs—electric power has advantages that gas has not; whereas for long runs and good working loads, the gas-engine with gas at a reasonable rate has yet to be beaten. When last describing the plant (towards the end of the year 1907), it was mentioned that it consisted of two 100-brake horse power gas-engines, with two sets of suction-gas plant. Coupled up with these are two dynamos, each capable of a continuous output of 65 kw. of 500 to 550 volts continuous current. The accumulator battery then also consisted of 260 cells, and could give 300 ampère hours in ten hours. Since then a new battery of double this capacity, and a new booster for it, have been put in. And, of more importance, the station has been practically duplicated by the installation of a 225-horse power oil-engine, directly coupled to a 150-kw. dynamo. Considerable economy is expected from the oil-engine; but it has yet to be proved. However, what with suction-gas plant and engines and an oil-engine at the electricity station, suction-gas plant and an electric motor at the water-pumping station, and town gas as a stand-by to the engines at the electricity station, Mr. Bullmore (in whose hands, as Resident Engineer, are entrusted the day-by-day management of all the public services here) ought to get some comparable working records under similar conditions of considerable interest.

The electricity is only being supplied in the factory area for power purposes; and the works that use electrical energy are also permitted to employ a certain proportion of it for lighting. The output of electricity has been progressive, in just about the same way as the gas supply, though, owing to the supply being for power purposes only, the average revenue per unit is small, and up to now the station has hardly paid its way. But there is no doubt as to the convenience of the supply to the factory owners; and it is satisfactory to learn that it is expected that this year there will be no loss after writing off depreciation. In all, fifteen factories are taking current. The year 1908 was the first of the service; and then the sale was 54,836 units. In 1909, the sale was 109,521 units; and in 1910 (it will be remembered the financial year ends with September), 170,350 units. Most of the increase has been obtained from existing factories through the extension of premises and their output.

Extension of the Water-Works.

A few words now as to the development of the water-works. Practically every house, shop, and factory throughout the area of the "city" is connected to the water-distribution system; and the demand, as in the case of gas, has developed at a fast rate. When describing in 1907 the plant that delivers water to this novel creation, it was stated that the pumping plant consists of a 35-horse power suction-gas engine and producer plant, driving high-service and borehole pumps of the Glenfield and Kennedy type—the two pumps working simultaneously. Since then a new borehole has been sunk by Messrs. Legrand and Sutcliffe; and the pumping plant and house have been exactly duplicated, except that the plant is driven, in this instance, by a 35-horse power electrical motor furnished with energy from the central power station. It will be of interest to learn at some future time the relative cost of working—conditions being so uniform and therefore so comparable—by electricity and suction gas. Each set of plant is equal to raising 120,000 gallons of water per day. The reservoir capacity is equal to 250,000 gallons; but an additional reservoir is now in contemplation. The water-mains have, like the gas-mains, been considerably extended. Beginning seven years ago with a system running through 4 miles of roadway, it extends now to 17½ miles. Regarding charges, for domestic purposes 5 per cent. on the rateable value is paid; and as the rateable value is low, the consumers get water at a very reasonable rate. Factories are charged by meter. It may be mentioned that the principle of transferring from revenue a fixed sum to a reserve account for repairs, maintenance, and renewal of works and mains also obtains in connection with the water undertaking. In this case 2d. per 1000 gallons distributed is set aside for the fund; and after charging repairs, maintenance, and renewals up to the end of Sept. 30 last, the balance in hand was £550.

These are the highly interesting developments in which we are concerned in connection with this remarkable scheme, which—under the able general management of Mr. W. H. Gaunt, the Company's agent—each year brings closer and closer the financial success which we hope will be its reward with a substantial fullness. The lines of development, it is seen, were as fundamentally sound as the intentions were socially beneficial.

We have received the "Mechanical World" Pocket Diary and Year Book for 1911. This useful little work has reached the twenty-fourth year of publication; and the present issue contains some 32 pages more than its immediate predecessor. A new section is on the "Constructional Details of Gas-Engines." The rest of the matter consists of useful engineering notes, rules, tables, and data. The number of illustrations has been increased by one-half, and the whole work thoroughly revised. The book is published by Emmott and Co., Limited, of Manchester.

Mr. Joseph Tysoe has, we regret to note, written to the Greenwich Borough Council resigning the office of Alderman. In the course of his letter, he stated that he had delayed taking the step in the hope that it would not be necessary; but he felt that, as he was still unable to take his fair share of the work of the Council, he ought not to occupy his position any longer. He very greatly regretted the severance from the work of the borough, but was advised that a quiet life and avoidance of excitement must be his chief care. The resignation was accepted, on the motion of Mr. Shaw, seconded by Mr. Scarr; both speaking appreciatively of Alderman Tysoe s services.

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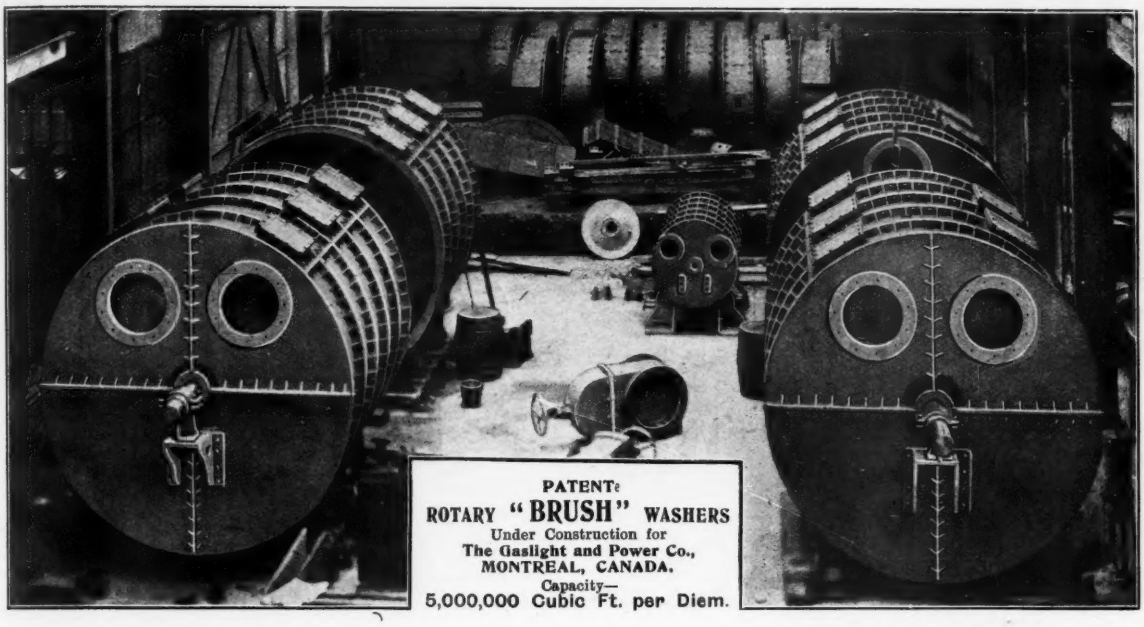

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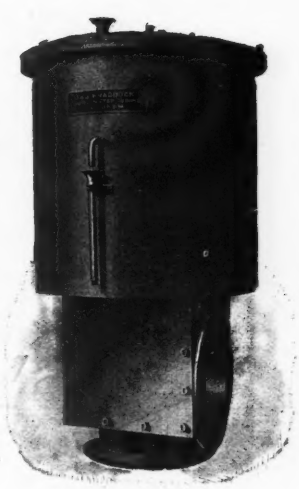

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GAS IN THE KITCHEN.

Once more the time has come—and gone—for the holding of the annual Cookery and Food Exhibition, which is deservedly one of the most popular of the many shows that take place at the Royal Horticultural Hall, Westminster. It is not many weeks since the doctors had an exhibition in the same building; and now there are the cooks. This is the order in which the respective displays are customarily arranged; but it will occur doubtless to many to question whether that is the proper sequence. The doctor after the cook is, we imagine, the more general experience of the order of things; but, then, that is not in connection with such cooks as were to be seen displaying their art last week at the twenty-first exhibition organized by the Universal Cookery and Food Association for the extremely praiseworthy purpose of spreading a better knowledge of the various substances used as food and the best and most economical methods of cooking. These are both objects which appeal to everyone; for we must all have food, and good cooking is little, if any, less important than good food. But for the gas industry, "the best and most economical methods of cooking" is a phrase which possesses a double significance. In addition to being of interest to them personally, it concerns them from a business point of view; for can they not, in the commodity which they dispense and the apparatus they supply, place at the disposal of the housewife, professional cook, or bachelor, the "best and most economical methods of cooking?" This is where our connection with the Food and Cookery Exhibition arises.

Larger, perhaps, than its predecessors—and certainly not less popular—this year's show attracted crowded attendances during the few days that it remained open. The commercial group included food and food products, kitchen and dining-room accessories, and culinary literature; and in other groups, domestic cookery and army and navy cookery were dealt with. Competitions there were without number; and the heavy programme of practical demonstrations drew some large and evidently practical audiences. The artistic confectionery group produced hundreds of specimens that were the marvel of those who beheld them; but perhaps equally remarkable were the entries in the banana cookery competition. For those who have not studied its possibilities, it might be hard to suggest a more uninteresting article of diet than the banana; and yet in the hands of the practised cook, the methods of serving it are evidently as varied as are the colours in a peacock's tail. When the art of cooking has attained to such a degree of perfection that even the banana can be transformed into a table delicacy which would sorely tempt the most fastidious gourmet, it is easy to realize how important it must be that the very best apparatus for the purpose should be employed. This is where gas comes in; for it admits of an exactness in cooking operations which is unattainable by any other system of heat raising—besides possessing undeniable advantages from the point of view of economy.

Gas is in the habit of being adequately represented at these cookery exhibitions; and this year's fixture has proved no exception to the rule. From afar off, attention was drawn to the Horticultural Hall by means of a large gas sign (which, by the way, if memory serves, replaced an electrical one formerly in position); and outside the premises there were some samples of the new Westminster inverted incandescent gas-lamps. Within the building, the Gaslight and Coke Company had constructed, on the first floor, a model gas kitchen, which was the scene of a large number of demonstrations of various kinds. There was a special charge for admission to these demonstrations (made by the Cookery and Food Association, and not by the Gas Company); but ladies were anxious to pay what was asked in greater numbers than could be at all times accommodated in the room, which would hold perhaps 150 persons. Here are some of the subjects of the demonstrations: Sugar modelling; a *recherché* supper; ice carving; to-morrow's dinner, and how to cook it; lace piping and lace modelling; simple breakfast and supper dishes; dressed vegetables. When the writer visited the kitchen, Mr. Edwin Schür was proving to a packed audience the extreme simplicity of his particular method of decorating cakes with sugar paste; and the moment that he had done, a fresh crowd streamed in to gather ideas from Mrs. C. Marshall in connection with tempting little breakfasts and suppers. How clean and bright everything was, and how unlike the traditional kitchen! Why, the intent ladies, with pencils and notebooks in hand, might have been listening to a lecture on comets, instead of watching actual cooking operations under practical conditions! Excellently lighted by means of eleven "N.I.C.O." inverted burners, having a total consumption of some 33 cubic feet of gas (beside which the electric lights looked dim and dull), the place struck one as being truly a model of what a kitchen should be. And yet everything had to be arranged by the Gas Company's staff in a very short space of time, and without driving a nail into the walls of the building. The paper, in imitation of glazed tiles, gave a pleasing effect to the contents of the kitchen; and a long row of copper stewpans, &c., of various sizes, supplied by Messrs. Jones Bros., of Down Street, Piccadilly, W., must have been the envy of many a housewife who cast her eyes on them. There was a Main enamelled treble-oven gas-range, with a continuous hot-plate, fitted with numerous ring burners and two small griller or toasting burners; and, in addition, there was a Main double gas-griller—one side of which can be used for meat, and the other for fish. A Sugg stock-pot stand, in solid cast iron, with two atmospheric burners, and a Sugg gas-heated boiler, also of cast iron, with a porcelain enamelled interior, were other articles. The Davis Company were represented by a gas-heated meat and vegetable steamer, with doors fitted with india-rubber, to make them steam-tight, and so arranged that when open each forms a shelf to pull the tray out on; a hot-closet; and one of the new "gilled" circulators, with thermostatic regulator. The attractive appearance of the kitchen will be gathered from the accompanying photograph. Every part of the apparatus was in full working order. The exhibition was opened by the Lord Mayor, who visited the model kitchen, and was extremely interested in all the appliances to be seen there.

Other gas-cookers were in use in one annexe, where a number of competitions and cooking displays took place. There were four Main double cookers, and a Sugg high-pressure gas-boiler, to give 100 gallons of boiling water per hour. At the time of our visit, a scone-baking competition on three of Fletcher's hot-plates was in progress. In the annexe devoted to the Shipping Federation, Limited, there were also Main double and single cookers, and a Wilson "Blackpool" boiler, for the purpose of showing the methods of cooking food in the merchant service.

Among the stands in the body of the hall, Messrs. R. & A. Main showed the "St. Nicholas" gas-fire and one of their new "D.S.O." series; and they also had on view the "Pilgrim" cooker—a steaming closet, in which the steam is raised in a copper water container by means of a gas-burner at the bottom. There is a steam-tight door, with a special facing and locking handle. It is made in two sizes, and claimed to be economical, efficient, simple, and cheap. Messrs. Arden Hill and Co. showed

Model Kitchen Constructed by the Gaslight and Coke Company.

the "Janus" gas-oven, specially adapted for baking bread and confectionery, the "Zenith" automatic high-pressure boiler, for delivering hot water to any part of a building, fitted with patent automatic valve; and the "Mars" gas-heated steam-radiator. Jones and Still's patent automatic boiling-water apparatus, and other appliances for hotels and restaurants, were exhibited by Messrs. W. M. Still and Sons; and a grease proof sink (which can be fitted with a gas water-boiler with ball-cock attachment), by Messrs. Frank Staines and Co. A gold medal was awarded to Jackson Boilers, Limited, for their gas-heated boilers, which are made in various styles for different uses. The café fountain water-boiler produces, it is claimed, a steady flow of boiling water five minutes after lighting the gas; and it is constructed to deliver boiling water only, as required, without steam pressure. The gas-burners under the counter are controlled from the boiling-water tap; and on the top of the apparatus there is fitted a patent steam condenser. The three stock sizes deliver respectively 150, 200, and 250 pints of boiling water per hour.

AIR ANALYSIS AND FLUELESS GAS-HEATED STEAM RADIATORS.

By H. James Yates, F.C.S., M.I.Mech.E.

The radiator form of flueless stove is now some twenty years old. It first took shape as a condensing radiator having an open gas-fire with fire-clay lumps. Some years later came a similar radiator without the open fire; and later still the same stove appeared as a non-condensing hot-air radiator. Eventually there was produced the gas-steam type which has become so familiar within the last half-dozen years or so, and has since been followed by several varieties of hot-air radiator. Following on the advent of the gas-steam radiator, there has rapidly arisen a great increase in the application of gas heating by flueless stoves of this class to a wide variety of domestic and industrial uses. Among the reasons for this were, no doubt, the fact that a reliable automatic control of the gas consumption in a quick-heating radiator was rendered possible, for the first time, by the medium of steam being introduced, with a consequent degree of economy in fuel and a resultant minimizing of the combustion products much beyond anything that had till then been attained. A further reason which has doubtless made for the popularity of the gas-steam type was that the products of combustion being kept out of the interior of the apparatus, there was no internal deposit to remove; and this, coupled with the absence of corrosion, meant an indefinitely prolonged life for the stove. Owing partly to the automatic control and partly to constructional arrangements to that end, the flame is effectually kept from contact with any part of the apparatus, and the invaluable feature of perfect combustion is ensured under all conditions.

It has been necessary to briefly recall these details to lead up to the very important question of flueless stoves in relation to the purity of the atmosphere. Section 6 of the Factory and Workshops Act states that the means employed to heat a workshop must be such as shall not interfere with the purity of the atmosphere; and from time to time doubts have arisen in official quarters as to the position of flueless gas-radiators in relation to this clause. As a matter of literal interpretation, no doubt, it might be argued that flueless stoves of any kind could be brought within the four corners of such a clause; but, obviously, a matter of so great importance and wide application must be viewed in a broad way, and providing that the combustion itself is perfect—*i.e.*, that no carbonic oxide is produced—the matter would seem to resolve itself into practically a question of the number of parts of carbonic acid per 10,000 parts of the atmosphere of the apartment.

The normal quantity of carbonic acid found in the air is, as is well known, from three to five parts per 10,000. Indoors, the respiration of the occupants naturally adds to this figure; and the Departmental Committee on Ventilation in Factories recommended, in 1902, that the maximum limit of carbonic acid permissible in the atmosphere of workshops should be fixed at twelve parts per 10,000 in the daytime, and twenty parts after dark, where gas or oil was used for illuminating purposes. Another Departmental Committee—that on Cotton-Weaving Sheds—recommended, last year, that these limits should be raised, in the case of dry weaving sheds, to fifteen and twenty-three parts per 10,000 respectively. It is important to remember, in passing, the wide distinction, as regards effect on health, between carbonic acid produced by respiration, and carbonic acid produced from inorganic sources. Carbonic acid produced by respiration is accompanied by a certain proportion of organic matter; and it is this latter which is the really serious factor to be guarded against. So that the carbonic acid respired is objectionable much more on account of this organic matter accompanying it—of the presence and proportion of which it is the index—than on its own. And, on the other hand, carbonic acid which results from inorganic combustion does not contribute organic matter to the atmosphere.

Obviously, therefore, the question is mainly one of analysis of the atmosphere of any particular apartment where the point may arise; and this has been recognized and acted upon by my Company, both in the devising and perfecting of gas-heated steam-radiators and in the working out of the method necessary for thoroughly establishing this form of gas-heating in the public confidence.

The following particulars show the practice they adopt in such cases. Of the two methods of analysis available (the gravimetric and the volumetric), the former involves prolonged work on the spot, and the taking about of considerable apparatus. The volumetric method, therefore, which is substantially as accurate for all practical purposes, is the one they have employed—particularly as it admits of samples of the air being taken on the spot, and returned to the works' laboratories for analysis. In order to accumulate the necessary data to work on, they have collected a large number of samples of air from various classes of apartments all over the country, and under all sorts of conditions. Each person taking samples has to fill up a "Report Schedule," and return it with the samples.

It will be seen from the form [on p. 391] that the schedule has been carefully drawn up so as to call for every particular of information which could possibly modify the result in any way. Their practice is to take the air samples in each case on two separate days on which the weather conditions are as nearly as possible the same. On the one day the radiators are kept entirely out of use; and the samples are taken just before the people leave at the end of the day. On the other day, the radiators are kept burning all day; and the samples are, again, taken about the same time. On neither day are the normal ventilation conditions of the apartment interfered with; and on both days samples are taken in several different parts of the room (the same places each day), and the results of the analyses of same are averaged so as to give one result for each day. The difference between the two days' analyses represents the effect of the radiators on the atmosphere of the room. Taking all the results thus obtained, one with another, they have found that generally the increase of carbonic acid on the second over the first—*i.e.*, with the radiators burning—is only about five parts per 10,000.

In this way they have established a definite constant factor for the contribution of carbonic acid by the gas-steam radiators. In most cases the total proportion of carbonic acid in the room at the end of the day (including the five parts contributed by the radiators) has fallen substantially short of the maximum of twelve parts per 10,000 put forward by the Departmental Committee. Where the analysis shows the total amount of carbonic acid to be excessive, it has invariably proved that the particulars in the report showed the ventilation conditions to be inadequate, except in one or two cases where the premises were found to be entirely unsuited for this form of apparatus, and where they would never have been installed had the makers been first consulted. In the former instances, they thereupon advised the owners to make the necessary improvements in the ventilation; and in the latter, to remove the stoves altogether. Flueless radiators are not intended for use in living rooms or in small apartments where the occupants are many and the means of ventilation few. Outside these limits, there is sufficient scope in all conscience for this type of apparatus, which possesses the indispensable quality of economy to be so marked a degree.

In the course of these analyses, an interesting sidelight has presented itself. In certain cases, the proportion of carbonic acid in these instances has proved to be actually less at the close of the day's full use of the radiators than on the previous day without them. This is due to the sluggishness of the normal ventilation being stimulated by the heat of the radiator.

The gas-flame has the valuable hygienic advantage, not only of killing a number of the micro-organisms that may be present in the air, but, by virtue of the naked flame, of burning up and destroying a considerable quantity of the organic matter exhaled by the human occupants of the room.

Reference may be made here to the fact that it has been found that, with the gas-steam radiator, a room can be heated with less gas than is needed to light it. Taking a workroom 30 ft. by 20 ft. by 15 ft. high, provided that no very close application to the work were needed, it would require six incandescent burners, each consuming 4 cubic feet of gas per hour, to light the room. If there were any bench-work or book-work to be done, for this size room it would require at the very least ten of these burners, consuming 40 cubic feet per hour. This room can be heated by means of two gas-steam radiators, only consuming 20 cubic feet per hour. It will thus be found that the amount of carbonic acid added by the gas-radiators to the atmosphere of a room is extremely small—particularly in proportion to that produced by the means of lighting, or by the number of human beings ordinarily engaged in a workroom of the size named.

Mr. J. W. Turner, Gas Manager to the Scunthorpe Urban District Council, was recently appointed to a similar position with the Abercorn District Council. On receiving notice to this effect, the Scunthorpe Council decided to advance Mr. Turner's salary by £30, with annual increments of £10 up to a stated amount, and to offer him a four years' engagement. These terms have been accepted.

AIR ANALYSIS REPORTS.

FORM G.

JOHN WRIGHT & CO.,
Essex Works, Birmingham.

IMPORTANT NOTE—It is absolutely essential that the person taking the sample of air should be careful to fill in every one of the particulars provided for in this form, excepting, of course, the Laboratory Report, which is to be left entirely blank.

Where a sample of the outside air is being taken, this must, in every case, be done on the ***Windward Side*** *of the Building.*

Bottle No. ..... Firm's Name ..... Business .....

Address .....

DESCRIPTION OF ROOM.

On Which Floor.	Height. Feet.	Co. tents. Cub. Ft.	No. of Occupants.	Space per Person. Cub. Ft.	VENTILATION. Windows. Aspect.	No.	Sizes. Ft.	Sizes. Ft.	Open during Test.	Open before Test. No.	Open before Test. Hrs.	Doors. A No. to Outer Air.	Doors. B No. to Inside Building.	Doors. Open during Test. A	Doors. Open during Test. B	Doors. Open before Test. No.	Doors. Open before Test. Hrs.	Ventilators. No. and description. State if open during Test, and what period, if any, before Test.	Fireplaces. State how many and how used, or if closed up.	LIGHTING. Electric. Arcs in Use.	Glow Lamps in Use.	Gas. No. of Incandescent Lights Burning.	Gas. No. of Ordinary Lights Burning.	Oil. No. of Lamps Burning.	HEATING. Nature of Apparatus.	No. Used during Test.	No. Used before Test.	No of Hours Used before Test.	PROCESS. Nature of Work. State if any chemical process giving off fumes.	Give particulars of any steam, gas, coke, or coal heated plant in room. State if in use during or before Test and if the latter, how long.
					N.																									
					S.																									
					E.															No. in use before Test.										
					W.															No. of hours in use before Test.										

CONDITIONS OF TEST.

Date.	Hour Work Started. A.M.	Hour Work Started. P.M.	Hour Sample Taken. A.M.	Hour Sample Taken. P.M.	Position in Room.*	Temperature.	Weather. Wind. Direction.	Weather. Wind. Force.†	Weather. Atmosphere.‡	Special Conditions, if any, such as "Wind blowing from direction of Sewage Works, 200 yards off."	REMARKS.
											Sample taken by— ..... Date despatched .....

LABORATORY REPORT (For Head Office use only).

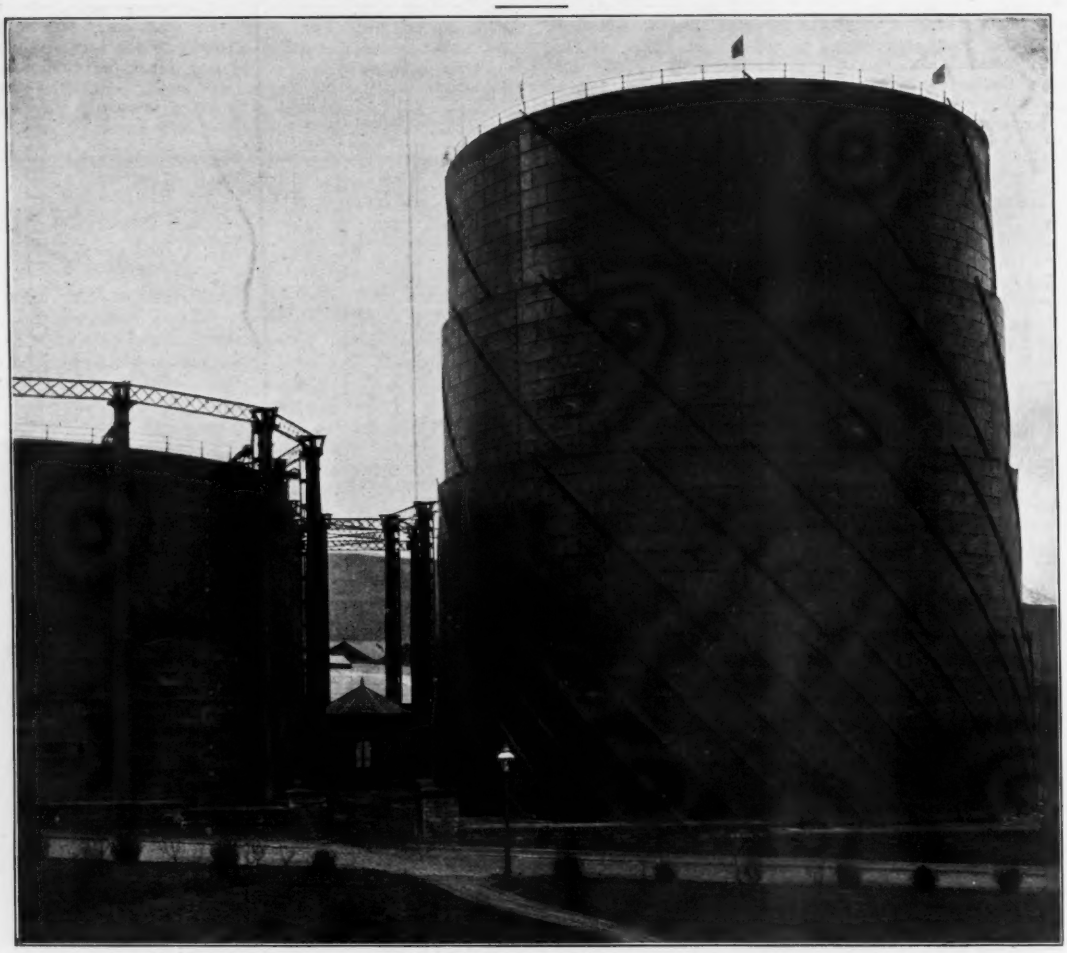
Vols. of CO^2 per 10,000. Inside Room.	Vols. of CO^2 per 10,000. Outside Air.	Micro-Organisms Per Litre of Air. Bacteria.	Micro-Organisms Per Litre of Air. Moulds.	REMARKS.
				Reported by..... Date.....

* Refer to mark or letter on rough plan [back of form]. † State if "gale," "blowy," "light breeze," &c.
‡ State if "rain," "fog," "mist," "snow," "dull," "bright," "frosty," &c.

[P.T.O.*

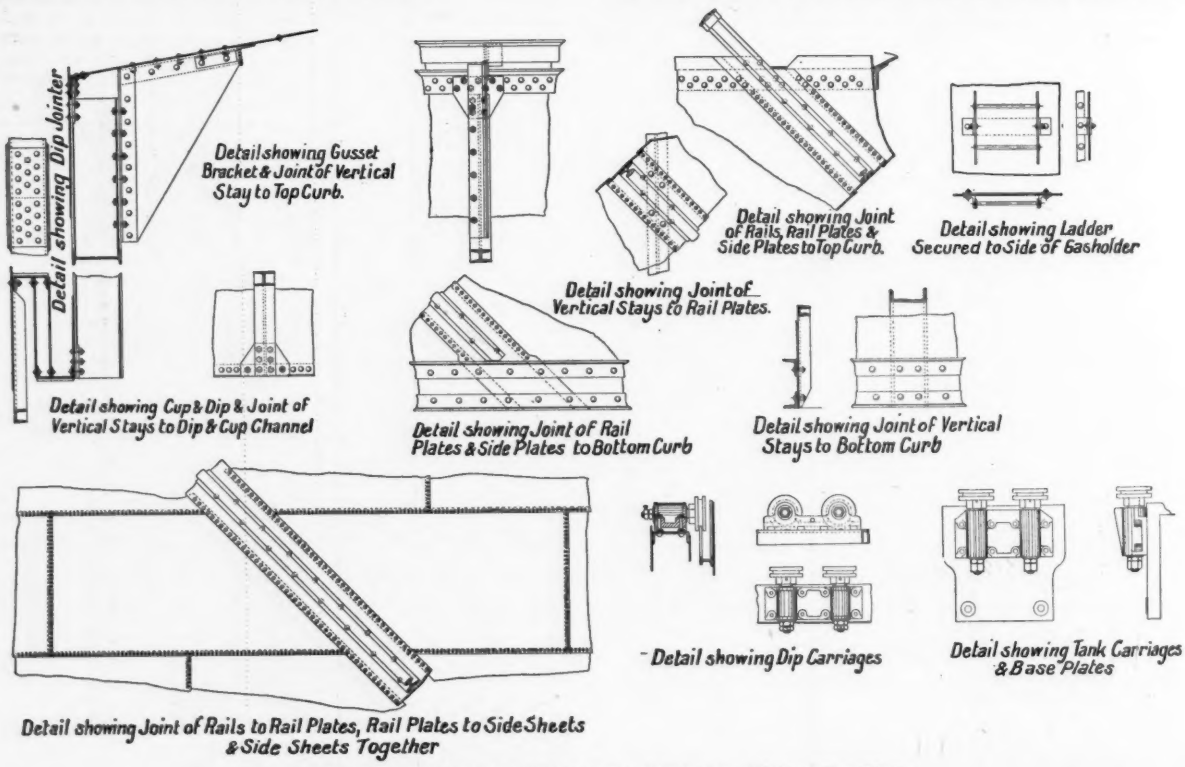
* The back of the form is reserved for the Analyst to give a rough plan of the room, showing in what part the sample was taken; and, if possible, he is to give a rough plan of the rest of the same floor.

A SPIRAL-GUIDED HOLDER AT OLDHAM.



YESTERDAY afternoon, there was inaugurated at Higginshaw Gas-Works of the Oldham Corporation a new spiral-guided gasholder; and a report of the proceedings which then took place will appear in the next issue of the "JOURNAL." Meanwhile, we are able to give particulars and illustrations which will show the nature of the work that has been carried out.

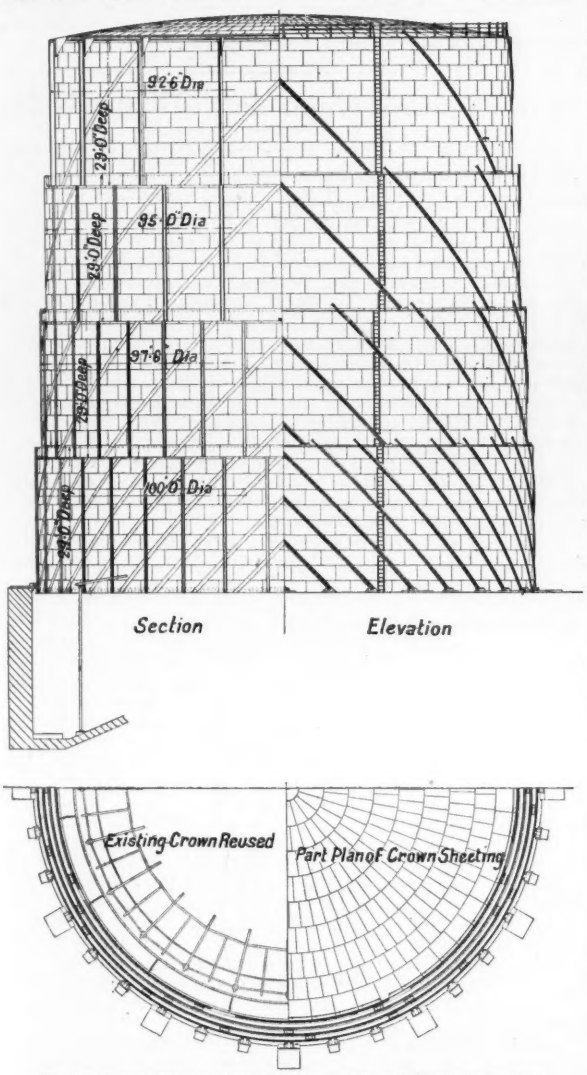
The Corporation had at their Higginshaw works a group of two-lift gasholders, guided by cast-iron columns. The first holder was erected in 1872; and, in consequence of its bad condition after 37 years' continuous work, the Corporation last year decided to replace it with one having four lifts. The holder which has been demolished was 100 feet in diameter by 29 feet deep, with two lifts, and in a brick tank with twelve cast-iron columns and


Detail showing Dip Jointer
Detail showing Gusset Bracket & Joint of Vertical Stay to Top Curb.
Detail showing Joint of Rails, Rail Plates & Side Plates to Top Curb.
Detail showing Ladder Secured to Side of Gasholder
Detail showing Joint of Vertical Stays to Rail Plates.
Detail showing Cup & Dip & Joint of Vertical Stays to Dip & Cup Channel
Detail showing Joint of Rail Plates & Side Plates to Bottom Curb
Detail showing Joint of Vertical Stays to Bottom Curb
Detail showing Joint of Rails to Rail Plates, Rail Plates to Side Sheets & Side Sheets Together
Detail showing Dip Carriages
Detail showing Tank Carriages & Base Plates

Details of the Spiral Guided Holder at the Higginshaw (Oldham) Gas-Works.

one row of lattice girders. Mr. T. Duxbury, the Corporation Gas Engineer, prepared plans for a new four-lift holder guided by lattice standard columns; and alternative tenders were also invited for a holder of the same size on the spiral-guided system—the outer lift in each case being 100 feet diameter, and each lift 29 feet deep. After carefully considering the tenders, and taking into account the large saving to be effected and the Contractors' guarantees with regard to the safety of the proposed new structure, the Corporation, on the advice of their Engineer, decided on placing a contract with Messrs. R. Dempster and Sons, Limited, of Elland, for a holder on the spiral-guided system.

The first, or inner, lift is fitted with 8 spiral rails, the next with 12, the next with 18, and the outer lift with 36, each of which is securely attached, by Dempster's well-known method of continuous diagonal plates. It might be here stated that the plates and rails are each in one length, without any intermediate joints; and wherever they cross the vertical stays, which are arranged in suitable numbers, they are securely attached thereto. The old gasholder was guided by twelve cast-iron columns. The existing twelve piers were utilized for securing twelve of the main carriages guiding the outer lift; and in between each of these main



Higginshaw (Oldham) Gasholder on Gadd and Mason's System.

piers were arranged two intermediate base-plates and carriages These base-plates were so designed as to be properly secured to the existing tank walls with the minimum of disturbance. The opportunity was also taken advantage of to replace the existing 18-inch inlet and outlet pipes by new ones with a diameter of 24-inches, built to special shape, so that they could be let into the tank wall without interfering with the diameter of the outer lift.

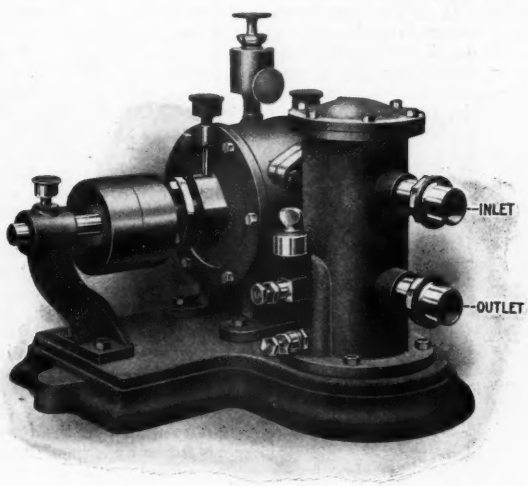
The work has been completed just within contract time. When fully inflated, the holder gives a pressure of 15⅝ inches; and the height is 109 feet from the top of the coping to the top curb of the holder, or 115 feet to the top of the crown. The proportion of the height to the diameter of the holder is notable; it being higher than engineers would at one time have considered safe. This, however, is simply a matter of calculation; and an ample margin of safety, we are assured, has been provided to enable the holder to withstand the severest gales that are encountered in this country.

A casual examination of the photograph of the holder here reproduced will convince one that the structure conveys the idea of strength. In fact, when it was fully inflated for the first time, a gale of wind was blowing; and the pressure-gauge indicated no variation in the pressure. We are informed that not one of the carriages required adjusting after they were fixed in the first instance; and we must confess that we have never examined a finer piece of work, as, although the holder was newly painted, not a single hammer mark or buckle was discernible.

Finally, it may be mentioned that all the work was carried out under the supervision of Mr. Duxbury, assisted by Mr. Dudley, the Station Superintendent.

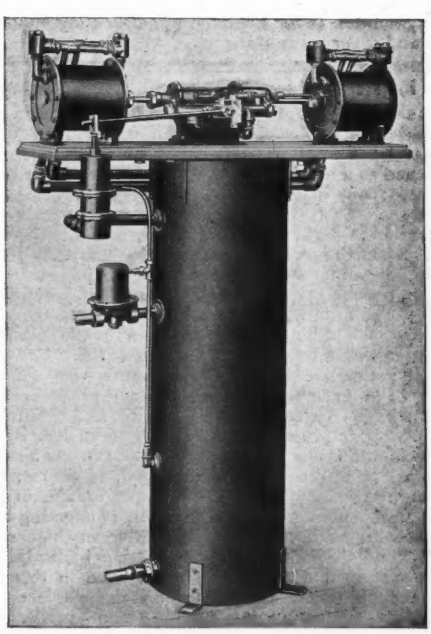
TILLEY'S HIGH-PRESSURE GAS LIGHTING AND HEATING SYSTEM.

In connection with the London and Southern District Junior Association's gas exhibition, which was noticed in last week's "Journal," brief reference was made to the high-pressure gas lighting and heating system of the Tilley High-Pressure Gas Syndicate, Limited, of No. 53, Kingsland Road, N.E. This is a system which had previously been alluded to in our pages; but it does not appear that any extended account has been given of the advantages claimed for this particular mode of compressing and consuming the gas. These details we are now in a position



Belt-Driven Gas Compressor.

to supply; and, in doing so, attention may first be given to the gas-compressors, which, it is maintained, are the most simple and perfect on the market—comprising, as they do, the latest patents granted for this purpose. They may be belt driven, electrical-motor driven, or water driven. The first illustration shows a belt-driven compressor. This comprises a rotary pump and valve-chamber fixed on one bed-plate. There is no gas storage reservoir; and the working of the valve can be instantly regulated during the time the plant is running. When the compressor



Water-Driven Gas Compressor.

is stopped, a full bore of low-pressure gas is, by the automatic action of the valve, immediately supplied to the service, without the aid of any supplementary bye-pass arrangement. The pressure, which is said to be absolutely steady, can be regulated by means of weights in the valve-chamber. For lighting, say, from 54 to 60 inches is desirable; while higher pressures can be utilized for certain trade heating appliances. The compressors are made in various sizes—with capacities of 500 cubic feet per hour and upwards; and as they require but little driving power, they can be driven by small gas-engines, electric motors, or from existing shafting. Then, again, they occupy but small floor-space; and a further advantage is that they are practically noiseless.

As stated, the Syndicate have also a patent water-driven compressor, which is eminently suitable for smaller installations, or for use where power is not easily obtainable. All that it is necessary to do is simply to connect it up with the ordinary water service; and this plant possesses the special advantage that the water, not coming in contact with the gas, can afterwards be used for other purposes. The gas compression can be adjusted up to 50 inches; but it is claimed that when working at from 36 to 40 inches, an efficiency of over 50 candles per cubic foot of gas can be obtained by the use of any of the lamps which will presently be referred to. This form of compressor is entirely automatic; the quantity of water employed being regulated by the number of burners at the time in use. An even pressure is maintained; and the apparatus is quite noiseless in operation. A special feature is made of simplicity in construction and working, and the small amount of attention required by the plant. In fact, it is well suited for lighting shops, factories, laundries, &c.

Patent inverted lamps designed for use with this system are supplied by the Syndicate; and they are constructed for lights of from 500 to 1500 candle power with single burners. Among the advantages which are put forward for these lamps (which it is stated have an efficiency of 60 candles per cubic foot of gas consumed at suitable pressures) are the means adopted for the perfect mixture of the gas and air, both of which are heated before reaching the point of combustion. The regulation is external, while the burner nipple or injector is readily removed from the top of the lamp for cleaning or renewal purposes. The place of ordinary gauze in the burner-nozzle is taken by a specially constructed nickel grid. In addition to the ease with which this can be cleaned, it, of course, does away with any question of the incineration of gauzes through the great heat at this point. There are also made smaller gas-lamps of similar construction, having lighting values of from 100 to 300 candle power; and high efficiency upright burners, of various candle powers up to 1500, are provided. For attachment to the lamps of either system, automatic high and low pressure bye-passes and distance igniters are furnished; and it should be mentioned that special care is taken in connection with the mantles used, so as to ensure the combination of high efficiency with durability.

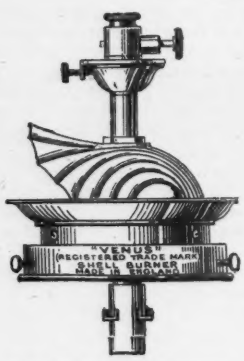
The Tilley High-Pressure Inverted Lamp.

In conclusion, we may remark that the Syndicate are devoting particular attention to the manufacture of heating appliances for laundries and other trade purposes.

Physical Basis of Steam and Gas Engines.

This was the subject of a paper read by Mr. Frank Foster at the Manchester Engineering Exhibition, which closed last Saturday. After briefly outlining the types of large gas-engines, the author turned to a consideration of the difficulties to be met by their makers; one of these being their cost as compared with steam-engines. As there seemed to be an impression that the high prices of gas-engines were artificial, he said it might be as well to point out the physical basis upon which they rested. In a standard compound steam-engine, the maximum steam pressure in the high-pressure cylinder would be 155 lbs. per square inch, and 20 to 30 lbs. in the low-pressure one. The maximum effective pressures would be 140 lbs. and 35 lbs.; while the mean effective pressures would be about 64 lbs. and 16 lbs. Thus the ratio of maximum effective to average pressure was 2·2 for each cylinder. In a gas-engine the maximum pressure might be 350 lbs.; and some cases as high as 500 lbs. had been registered. The mean effective pressure was only 30 to 32 lbs., so that the ratio of maximum (assumed at 350 lbs.) to mean was about 11 lbs., or five times that of the steam-engine; and, of course, the parts had to be strong enough to withstand the maximum pressure. By putting two cylinders in tandem, the connecting-rod, main frame, and crank-shaft were not subjected to any higher stresses; but the intermediate frame, back piston-rod, cylinder barrels, and valve-gear remained as before. Hence, even in this case, the ratio of maximum to average pressure for the whole engine was nearly 4 lbs., as against 2·2 lbs. for the steam-engine. Further, the severe conditions under which the gas-engine worked necessitated more expensive materials than in the case of steam-engines. The wonder was that gas-engines were so cheap.

THE VENUS "SHELL" BURNER.



The Venus "Shell" Burner.

The accompanying illustration shows the Venus "Shell" burner of Mr. B. Cars, of Tabernacle Street, E.C. It is supplied in polished brass, steel bronze, and oxidized copper. The burners have heavy, cast-brass gas-regulators, fitted with reliable stuffing-boxes, making any leakage of gas next to impossible. Each burner has an anti-back-lighter, gives a steady, pure light equal to some 80-candle power, and has a consumption of 3 cubic feet of gas per hour. The burners are all fitted with square lug-nozzles, taking ordinary inverted mantles and ordinary inverted globes.

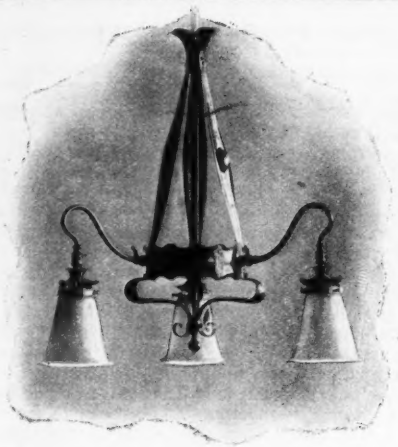
ARTISTIC GAS-FITTINGS AND OTHER THINGS.

It is always a pleasure to be able to record business expansion, whether in the manufacture and distribution of gas or in the trade of individual firms who provide appliances for consuming the gas; and fortunately it is by no means infrequently that we are able to avail ourselves of this pleasure. An opportunity now occurs; for, in the course of a recent interview, Mr. George Hands made it abundantly clear that the business of Messrs. G. Hands and Co., whose temptingly fitted show-room in Farringdon Road was some time ago the subject of an appreciative notice in our columns, is a rapidly developing one. Very material evidence of this is forthcoming in the fact that the firm have now found it necessary to issue a catalogue which, for size, get-up, and attractiveness of the contents, is worthy to take its place by the side of any that we remember having seen in connection with the gas-lighting business. The compilation of nearly 200 pages of prices, particulars, and illustrations is a big task, as others have found before; and the fact that it has been thought requisite to undertake the work, shows how great is the variety of articles there are to choose from.

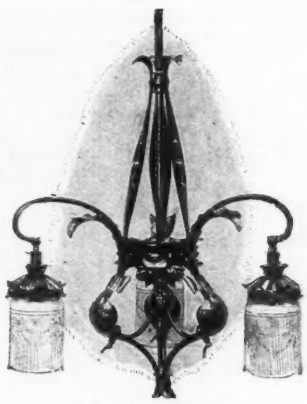
It is a long while since the firm first established a reputation in the industry for the supply of artistic fittings; and one can assert with confidence that the future is likely to enhance this reputation rather than to diminish it. Mr. Hands firmly believes that one of the best ways of combating the electric light is by providing gas consumers with really handsome fittings. The show-room is filled with brackets, pendants, &c., in hand-beaten art metal work; and the illustrations on p. 395, taken practically at haphazard, will give some indication of the elegant character of the goods to be seen there. But if the fittings are to be of a high order of excellence, it is most desirable that they should be protected from any possibility of discoloration; and this it is claimed is accomplished by the use of the Hands patent "Cool" inverted burner, which can be had in various sizes. In addition to the fact that it will not cause discoloration of the fittings on which it is used, another advantage possessed by it—as the name implies—is that it is always cool for the adjustment of the air or the gas. The stated lighting efficiency of these British-made burners is 80-candle power for 3 cubic feet of gas per hour. The "Cool" burner is, we learn, making its way among gas undertakings in a highly satisfactory manner. In speaking thus of artistic fittings, it must not be thought that they are all of an expensive kind. Far from this being the case, the requirements of every class of consumer are catered for in every style of gas lighting appliance.

Another speciality is the "L'Fin" inverted cluster burner, also of British manufacture, and made in three sizes, and for two or three lights. The burner-head (which is made entirely of china, so that there is no chance of discoloration) can be lifted off in a moment for cleaning purposes; and every part is interchangeable. The cluster is suitable for street-lamps, church lighting, and domestic use; and it is said to possess a very high lighting efficiency—about 100-candle power for a consumption of 3 cubic feet of gas per hour. The firm's "Whitelight" mantle, too, is in great demand. The chief feature of this is the special mesh of the mantle stocking, which is formed by a number of straight ramie threads crossing each other horizontally and vertically—thus forming a square network on the principle of a piece of linen, loosely woven. "These straight threads," it is pointed out, "really form small firm cells capable of great resistance, being very elastic. The construction is such that, instead of the weight of the mantle hanging on a single thread, each of the straight threads carries only its own weight—this fact being the explanation of the enormous durability and power of resistance which the 'Whitelight' mantles undoubtedly possess." The inverted mantle is of the same texture and thickness in every part, having only one vertical seam right round it; and a perfectly uniform light is emitted from all portions.

An important feature of the catalogue is the section devoted to



The "Wyndham."



The "Bromley."

The "Rhyl."

SPECIMENS OF MODERN ART GAS-FITTINGS.

specially designed inverted fittings suitable for churches, public buildings, schools, &c. This is well worthy of careful study by those who are, or are likely to be, concerned with the problem of lighting such places in an efficient manner by means of absolutely up-to-date fittings. The range covered is of the widest imaginable; and so there should be found among them something to suit every style of building. Another division deals with fittings for prepayment meter installations; and there is also a comprehensive list of small gas-fittings and gas-works tools, which is quite a new departure by the firm. Soon we shall be having with us the Coronation rejoicings; and suitable opportunity will then present itself for the fitting up of illumination devices for gas. Well, even of these Messrs. Hands and Co. offer a variety of patterns—some the most simple and others the most elaborate that could be desired. Finally, a word must be bestowed upon the well-known patent outdoor lamps of the "Dreadnought" type, which have been adopted by some of the largest gas undertakings for hiring-out purposes. These have been often tried, and have not been found wanting.

LIVERPOOL ENGINEERING SOCIETY.

Extracts from Inaugural Address of Mr. Edward Allen, M.Inst.C.E.

THE Engineer of the Liverpool United Gaslight Company—Mr. EDWARD ALLEN, M.Inst.C.E.—is the President of the Liverpool Engineering Society for the current session; and at the opening meeting of the Society last Wednesday he delivered his Inaugural Address, which was devoted mainly to the progress of the Company and the industry with which he is connected.

Mr. Allen began by expressing his full appreciation of the honour conferred upon him by his election as President, and by thanking members of the Society for this mark of their favour. He said he could not but feel that the appointment had, to some extent, been influenced by his official connection with one of the largest and most important industries of the city—the Liverpool United Gaslight Company. If this assumption was correct, he was placed under a double obligation of gratitude and fidelity, and would gladly acknowledge this graceful recognition of the important public position occupied by the Company. In this connection, he thought it might be interesting to give some particulars of its history during a period which had nearly reached a century; and this he proceeded to do, as follows.

HISTORY OF THE LIVERPOOL UNITED GAS COMPANY.

In the year 1815, a gentleman of the name of Hargraves, who represented himself as having been Engineer to a London Gas Company, came to Liverpool and called upon several influential gentlemen with the object of forming a gas company. He was fortunately able to gain the support of a Mr. Varty, a local coach-builder, who took the matter up with so much zeal and ability that on the 16th of October, 1815, the first meeting of subscribers was held at the Crown Inn, in Redcross Street.

A small plant was erected on Mr. Varty's premises in Dale Street, from which gas was supplied to two large lamps, each containing three lights, situated at the front of the Town Hall. These were first lighted on Jan. 23, 1816, and excited much attention; large crowds of people gathering to see the brilliant illumination obtained from coal gas. Mr. Varty states that he saw several persons touching the iron gas-pipe to ascertain whether it was hot, with the idea that fire was being conveyed through the pipe. Some alarm was caused among the directors of insurance companies, who feared the use of gas would lead to conflagrations.

This exhibition and others enabled capital to be raised. Gas-works were erected at the corner of Hatton Garden and Dale Street, and gas-mains were laid in the streets during 1816. The first supply of gas to the public took place on Jan. 3, 1817.

The capital subscribed in 1816 consisted of 200 shares at £30—£6000; and this was doubled the following year. The revenue from gas and the residual products sold the first year amounted to £2585. It may be interesting to note that the present capital is nearly £2,000,000, and that last year's revenue almost reached the sum of £640,000.

As soon as possible, the Directors sought and obtained statutory powers. The first Act of the Company—58 Geo. III., cap. 66 (May 23, 1818), authorized them to raise £50,000, in 500 shares of £100 each, and all other powers necessary for carrying out the objects of the Company.

The success of the Company led to the formation of a rival undertaking; and in 1822 a Company was enrolled to supply the town with gas manufactured from oil, and works were erected at Rose Hill. The cost of this gas (about 45s. per 1000 cubic feet in the earlier years and 30s. later) heavily handicapped the undertaking; and in 1834 the Company went to Parliament and obtained permission to manufacture gas from coal and any other materials whatever. In the years 1843 and 1844, unsuccessful attempts were made to form a third gas company under the auspices of the Guardian Society.

While competition may be good for business generally, this cannot be said of gas undertakings operating in the same area; and the experience in Liverpool was such that ultimately, in 1848, by the advice of the corporate authorities, the two Companies amalgamated, and hence the present title—"Liverpool United Gaslight Company."

In regard to the offices, it is interesting to note that those of the old Company were situated in Dale Street from its formation until 1849, when a removal was made to Newington. In 1854, the Dale Street premises were sold to the Corporation, and the present Police Courts built on the site. The new Company removed their offices from Rose Hill to Queen's Square; and in 1849 the business of the united Company was transferred to the very handsome premises, already referred to, erected in Newington. The site was acquired by the Cheshire Lines Committee on June 24, 1870, and the Gas Company's business was carried on temporarily in Cornwallis Street until the new offices in Duke Street were entered on July 1, 1872.

As to the works, the original installations of each Company were discarded at an early period in favour of more commodious and convenient premises situated in Eccles Street and Athol Street, on the Leeds and Liverpool Canal; and though the plant and apparatus have been from time to time supplanted by those of modern design, most of the old buildings remain intact, and are a credit to those who erected them eighty years ago. In 1847, additional works were erected in Caryl Street (then called Harrington Street); and they were opened on Oct. 16, 1847. Then followed the Wavertree works, opened on Oct. 1, 1856. These were the first of the Liverpool works to have the advantage of being connected to a railway system. The development of Liverpool to the north which followed the extension of the docks, and the growth of the township (now Borough) of Bootle, led to the erection of the Linacre Gas-Works, opened in October, 1867. The next and latest addition to the works of the Company was at Garston, at the extreme southern end of the area of supply. Gas was distributed from these works in March, 1895.

The Engineers to the Company have been few in number. The first was Mr. Sadler, whose son (Mr. John M. Sadler) was a member of this Society for many years; but he appears to have resigned in 1902. Mr. Sadler was one of the pioneers in the navigation of the air, and, like many of the brave and clever men who have lately been labouring in this field of engineering, he lost his life while ballooning, and joined the "noble army of martyrs" to the cause of science. He was succeeded in 1822 by Mr. John King, a son of Mr. Joseph King, of Liverpool, the compiler of the well-known "Tables of Interest." On his death, in 1826, the Directors invited his brother, MR. Alfred King, to take the position. He accepted the invitation, and for forty-one years held the appointment, with eminent ability and success.

It may safely be said that few names will be longer identified with the history of gas lighting than that of Alfred King.

The industry owes much to him for improvements in the processes of the manufacture and distribution of gas; and to his great skill and foresight, his business capacity, and his high personal character is largely owing the success of the gas undertaking in this city. At his death, in 1867, the Directors appointed his son, Mr. William King, to be Engineer to the Company; and after thirty-seven years of very able and faithful service, he retired from the position in 1904. He is a member of this Society, as well as of the Institutions of Civil and Mechanical Engineers. He has long been a distinguished leader in the gas industry, and a recognized authority in his profession.

Progress of the Gas Industry.

The gas industry has made enormous strides since William Murdoch lighted the works of Messrs. Boulton and Watt at Soho, Birmingham, by means of coal gas, in 1803. There are now undertakings in every centre of population in this and all other civilized countries. English enterprise established gas-works on the Continent at a very early date; and even to-day there are gas-works in France, Germany, Italy, and other countries, owned and carried on by English companies.

The present position of the gas industry in the United Kingdom may be indicated by the following statistics, taken from the Board of Trade returns.

Number of undertakings (authorized) . . .	790
Capital employed (paid up and borrowed). .	£130,708,693
Gas made.	189,918,737,000 cub. ft.
Coal used	15,394,307 tons.
Average number of persons employed weekly	64,584

These figures demonstrate the important position of gas manufacture among the industries. It would be difficult to form an estimate of its value for business and social purposes. Originally introduced as a source of light, it is now largely used to provide heat and power. As a rival to coal for these purposes, gas has made rapid progress and is deservedly popular.

One of the great problems yet remaining to be solved is that of purifying the atmosphere of our large towns. Professor A. H. Church recently drew attention to the destructive action of London rain on stone buildings, and more especially on portland stone; and he mentioned that annually something like 500,000 tons of sulphuric acid are deposited over the London area as a result of the enormous combustion of smoky coal. Professor Cohen, of the Leeds University, contributed a paper to the Health Congress last year on the "Quantity and Nature of Impurities in the Atmosphere of Leeds and Surrounding Districts,"* and said that "he found by experiment that the production of soot from coal varied from ½ to ¾ per cent. from boiler furnaces, but reached an average of 5 per cent. from domestic chimneys." These results have been fully confirmed by a variety of observers. So long since as the year 1881, Sir William Siemens, F.R.S., said: "I am bold enough to go so far as to say that raw coal should not be used as fuel for any purpose whatsoever, and that the first step towards judicious and economic production of heat is the gas-retort or gas-producer, in which coal is converted either entirely into gas or into gas and coke, as is the case at our ordinary gas-works." It is evident, therefore, that the gas industry provides a simple solution for the great "Smoke Problem;" and so far as it is made use of, it is a public benefactor.

Engineers and the Gas Industry.

It is interesting to engineers to know that their profession not only finds occupation in providing and operating the plant and machinery of gas-works, but in manufacturing the multitudinous appliances in which gas is used for various purposes. In reference to the former, it is gratifying to know that the spirit of improvement was never more evident than at the present time. The old plant is giving place to the new. The process of carbonizing coal was originally carried on by means of vertical iron retorts. These gave way to iron ovens; then followed horizontal iron retorts, shortly to be changed to those of fire-clay.

At this stage there was a period of rest, slightly disturbed in some places by the substitution of mechanical stokers for hand work. An attempt to introduce retorts set at an angle ("slopers") was at first a failure; but on the early faults being removed, the system found favour. In the meantime, greatly improved mechanical stokers were invented, which enabled horizontal retorts to once more lead the way. Within the past few years, however, vertical retorts have reappeared; giving a larger make of gas per ton, and lower costs of working, than have previously been obtained. The oven has also been revived, and claims many advantages. Not to be outdone, the horizontal retort, working with full charges of coal over a lengthened period, is stated to be the most satisfactory carbonizing vessel. What has been said about carbonizing plant may also be applied to plant used in the other processes of gas-works.

The battle is still raging; and while the "survival of the fittest" applies as truly in the works of Science as in those of Nature, it is difficult for an engineer to foretell the result. There is one admirable feature in the struggle for supremacy that is seen in the conduct of gas engineers. Nothing is kept secret; each man is willing to show his plant and process to his neighbour, and to compare results. Unlike manufactured goods that compete in every market, the products of a gas-works are for local consumption, and every community may benefit by any improvement invented elsewhere.

Progress in Allied Industries.

The spirit of progress is not confined to gas-works, but permeates the allied industries. The old fishtail and batwing burners, having a duty of (say) 4 candles per cubic foot with the best quality gas, are giving place to incandescent burners having a duty of 60 candles. The pattern of gas-bracket or chandelier which obtained for many years is thrown on to the scrap heap, and the light, graceful, and artistic fitting which harmonizes with the brilliant light is now provided.

The limits of this address do not permit more than the briefest reference to the recent improvements in gas-cookers, gas-fires, and gas-engines. The skill of the engineer and the learning of the chemist have been devoted to these appliances with remarkable success; and the practical or effective calorific value now more nearly approaches the theoretical quantity. Success in this direction, however, can only be achieved when the gas made by all undertakings is of uniform composition. The shape of flame given by 20-candle gas is very different from that of 14-candle gas, and therefore a gas-fire that is highly efficient with the latter quality may be very imperfect with the former, though its calorific value is greater, for the simple reason that the shape and size of the fire-clay or other refractory material have been made to suit the flame formed by the lower-quality gas. The same thing applies with even greater force to incandescent burners, as the best effect can only be produced when the hot zone of the flame is in complete contact with the mantle.

In the gas industry, as in others, efficiency and economy can only be attained by standardization. It is gratifying to know that the old "rule-of-thumb" methods are being replaced in all branches of engineering by rules of exact science. The prejudice in favour of what was called "practice" as against "science" is passing away, and we are finding that these should not be considered as in opposition, but that our "practice" should be based upon "science." Credit for this is due to the greater facilities given for technical education in the day schools and the evening classes promoted by Education Committees, as well as in the universities and colleges of our country. In this way the level of the artisan has been greatly raised, and he has been able to respond to the higher calls made upon him.

Special Training in the Gas Industry.

Mr. Allen next referred to the vast amount of attention which has of late years been given to special training in the gas industry. In this connection, he mentioned the classes on "Gas Engineering" and "Gas Supply" held under the auspices of the City and Guilds of London Institute; the research work carried on at the Leeds University in memory of the late Sir George Livesey; and the lectures recently arranged by the University of Manchester as the result of the movement initiated by the Junior Gas Association of the district, and supported by the Manchester District Institution of Gas Engineers. It would thus be seen, he said, that the gas industry is throbbing with life and vigour, eager to solve its problems, and to place in the hands of its master (the public) the most perfect light, heat, and power that can possibly be produced from gas at a minimum cost. He added that the same spirit of enthusiasm was found in every branch of engineering; and the Liverpool and kindred societies existed for the purpose of promoting its growth, and guiding it into right channels.

Closing Remarks.

In conclusion, the President apologized for the lack of attention to the many important branches of engineering the members of the Society represented, and explained that the omission was not due to any want of appreciation on his part, but rather to a feeling that one could be more interesting, and speak with more authority, when dealing with his own special subject.

* See "Journal," Vol. CVIII., p. 613.

Retirement of Mr. Henry Austin.

It may be remembered that at the annual co-partnership dinner of the employees of the South Metropolitan and South Suburban Gas Companies at the Crystal Palace in July, Mr. Henry Austin, an Employee-Director of the first-named Company, referred to his approaching relinquishment of the position, and took the opportunity of bidding the co-partners farewell, and wishing them "success and double success." We learn from the Company's "Co-Partnership Journal" for November that the event alluded to takes place this month. In recording the fact, the Editor (Mr. Walter T. Layton) says: "For full twelve years Mr. Austin has represented his fellow-employees with conspicuous ability and with a whole-hearted devotion to the Company and the co-partnership movement. Sir George Livesey, in speaking of the profit-sharing meeting on Nov. 21, 1889, alluded to 'our friend Austin, who was the orator of the occasion.' Years have intensified, rather than toned down, the enthusiasm of our senior representative on the Board; and it is generally recognized that co-partnership has no abler advocate in the ranks of the Company's employees. The best wishes of all co-partners will go with him into his retirement; and we feel certain that he will still be a welcome visitor at the social gatherings of those whom he has so long represented."

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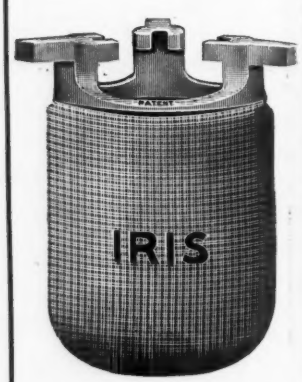

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AMERICAN GAS INSTITUTE.

Fifth Annual Meeting.

In accordance with the arrangements previously announced [see *ante*, p. 245], the fifth annual meeting of the American Gas Institute was held in New York from the 19th to the 21st ult., under the presidency of Mr. W. H. Bradley, Chief Engineer of the Consolidated Gas Company. The following particulars of the proceedings are taken from a summary by a correspondent of the "American Gaslight Journal."

The members assembled shortly after ten o'clock on the morning of the first day, in the hall of the Engineering Societies' Building. The principal feature of the sitting, was, of course, the President's Address, which dealt largely with the question of maturing and spreading the interests of the Institute. Our contemporary says one might well have supposed the address to have been "the work of a well-trained man of letters, or the tabulation of facts by a barrister of fame, rather than the compilings of one whose active life has been intimately bound up in the practical working out of engineering problems, the magnitude of some of which are remarkable even in this age of wonderful achievement." The reports submitted by Committees and other standing bodies, notably those from the Boards of Directors and the report of the Trustees of the Gas Educational Fund, showed that the Institute is progressing smoothly in every respect. There were fourteen items on the programme for the morning sitting; and only two of them had to be deferred on account of the temporary absence of members of Committees.

The papers which attracted the greatest attention on the first day were those of Mr. J. Hawley Taussig and Mr. J. M. Morehead; the former dealing with the "Utilization of Waste Heat in Water-Gas Apparatus," and the latter with the "Determination of the Calorific Value and Operating Conditions from Analyses of Industrial Cases." A paper by Dr. A. C. Humphreys, bearing the title of "The Public Deceived by Faulty Data and Misleading Analyses of Data," was scholarly and convincing. "The Lighting and Ventilating of Gas Appliance Display Rooms," by Mr. T. Scofield, described, with the aid of the screen, the Consolidated Gas Company's display at their City House. Three other papers similarly illustrated were "The Laying of the 48-Inch and Two 36-Inch Gas-Mains under the Harlem River," by Mr. C. C. Simpson; "Pneumatic Caulking with Lead Wool of 30-Inch, 36-Inch, and 48-Inch Gas-Mains," by Mr. C. C. Simpson, jun.; and "The Laying of a Pair of 30-Inch Cast-Iron Mains under the Passaic River," by Mr. A. H. Strecker. Other business transacted was the presentation of the Wrinkle Budget by the Editor (Mr. R. C. Congdon), and the award of the Beal Medal for the best paper at last year's meeting to Mr. W. H. Fulweiler, for his communication on the "Physical Theory of Coal Carbonization."

The election of officers resulted as follows:—

President.—Mr. D. M'Donald, Louisville.
First Vice-President.—Mr. W. C. Morris, New York.
Second Vice-President.—Mr. J. D. Shattuck, Chester (Pa.).
Secretary and Treasurer.—Mr. A. B. Beadle, New York.

The technical proceedings of the second day included a paper by Mr. W. J. Clark, of the West Chester (N.Y.) Lighting Company, on "The Cultivation of Friendly Relations between the Public and the Lighting Company." Our contemporary's correspondent says the discussion on this paper was one of the best that was ever had before any technical society. A noteworthy incident of the day was an invitation by Mr. J. W. Ellis, President of the Providence (R.I.) Gas Company, to members to visit the Providence plant, to see in successful operation a vertical retort plant of the Didier-March type, as installed by Mr. F. J. Mayer. An important communication submitted was one by Mr. H. W. Alrich, on "Brick, Concrete, and Steel Tanks for Gasholders," the first portion of which appears elsewhere. The papers, of which a list has already been given, will be noticed more fully in subsequent issues of the "JOURNAL."

The banquet on the evening of the second day took place in the ball-room at the Hotel Astor, and was a brilliant gathering; and the social functions of the meeting were all successful.

Electrolysis was found to be the cause of the pitting of a 6-inch main removed from one of the streets of Beaumont (Tex.). The Telephone Company of the city, according to a report of a Committee of the National Board of Fire Underwriters, formerly experienced trouble from this cause in connection with their underground cables. These are now bonded at each manhole to an overhead return feeder to the street railway power-house; and tests have shown that troubles from electrolytic action are obviated.

The report presented at the recent annual meeting of the Junior Institution of Engineers furnishes evidence that the organization continues to do good work. In the past session there were nine ordinary meetings for the reading and discussion of papers; and a large number of visits were paid to engineering works. At the close, the membership was 1089. The new President is Sir J. J. Thomson, F.R.S., of Cambridge; and Mr. J. Wylie Nisbet has been elected Chairman of the Council. The Secretary of the Institution is Mr. Walter T. Dunn.

THE PHENOMENA OF EXPLOSIONS IN GAS AND OTHER INTERNAL COMBUSTION ENGINES.

By DUGALD CLERK, F.R.S., M.Inst.C.E., F.C.S.

[A Lecture delivered at the Manchester University last Saturday.]

The experimental determination of the properties of gaseous explosions presents very considerable difficulties, which require for their solution serious expenditures both of time and money.

Until recently no urgent commercial need pressed for exact knowledge on the subject. The steam and hot-air engines hitherto used dealt with their working fluids at comparatively low temperatures; and, accordingly, chemists and physicists, with a few honourable exceptions, had not applied themselves seriously to the exact determination of the necessary constants required to understand the behaviour of the gases formed in gaseous explosions at high temperature.

The study of the history of nearly all important inventions proves quite clearly that very considerable practical success may be attained prior to the existence of any really exact scientific knowledge. The steam-engine, for example, attained to a relatively high development long before the science of thermodynamics came into existence. Newcomen's engine was produced early in the Eighteenth Century; and was considerably used in England until a study of its defects suggested to James Watt that better things might be done. Watt experimented at the Glasgow University with an old Newcomen model, and produced a condensing steam-engine with a separate condenser. In this work he was aided by a knowledge of the researches upon the latent heat of steam made by Black, Professor of Chemistry in the University of Glasgow. Watt added to that knowledge, however, by means of his own experiments on the pressure and temperature of steam; and he considered that he had established that the quantity of heat required to convert a given weight of water into saturated vapour was the same whatever the pressure of the vapour might be. This supposed property was known as "Watt's Law" for many years, although it was afterwards shown to be wrong. Errors in his theories, however, did not prevent him from improving the principles and construction of his steam-engine; so that Watt lived to see his engine applied to all the great duties of the mine, the water-works, the factory, and the steamship. He also saw the beginning of the steam locomotive. All this practical progress was made at a time when scientific men still believed in the material theory of heat, and no science of thermodynamics had come into existence.

The story of the gas-engine shows the same imperfect knowledge and the same considerable practical success attained, notwithstanding ignorance. In 1876, for example, Dr. Otto thought his success due to the use of stratification in his engine; while, in actual fact, stratification had nothing whatever to do with it. His success was wholly due to correct mechanical detail, and the effective use of compressed gaseous mixtures. The history of the dynamo shows the same thing—crude and imperfectly understood machines attaining great success; and the development of the steam-turbine in its early stages shows considerable success based on relatively imperfect knowledge.

Pure science seldom supplies motive sufficiently powerful to induce the necessary expenditure of means and labour always required for exact quantitative work. The requirements of industry have really given rise to most of the exact science of to-day. Under the stimulus afforded by the growth of the steam-engine, physical constants for steam, air, and other gases and liquids have been exactly determined. Indeed, the whole science of thermodynamics appears to have originated in its study. Quantitative electricity as an exact science is largely indebted for its present position to the industrial requirements of electric lighting and telegraphy.

In inventions, practice generally exists first, without adequate explanation, and science concerns itself, in the first instance, with an attempt to explain practice by theories. In modern times this attempt to explain is partly experimental, partly mathematical; and the experiments and consequent deductions lead to the discovery of new facts which themselves both aid explanation and require explanation. All important inventions thus arrive at a stage when further progress can only be made by minute study and a complete knowledge of many facts which had not been required in the early stages. The internal combustion motor has arrived at this stage. Further progress becomes more difficult, and a full knowledge (in the scientific sense) of all the properties and phenomena of the working fluid is necessary to furnish guiding ideas for future changes.

An interesting discussion was held in 1907 at the Leicester meeting of the British Association between the Engineering and the Chemical Sections upon the properties of gaseous explosions. Chemists, physicists, and engineers took part in this discussion; and Continental investigators were well represented—including Dr. Holborn, of Berlin, Dr. Haber, of Carlsruhe, and Dr. Boudouard, of Paris, representing M. Le Chatelier, whose early work is so well known. The state of knowledge as to gaseous explosions was shown to be somewhat indefinite—conflict existing as to material facts; and it was felt that co-ordination among investigators was urgently required. A British Association Committee was formed, which includes practically all the investigators of Britain who interest themselves in the internal combustion

engine, with the idea of overcoming difficulties by frequent meetings and discussions between physicists, chemists, and engineers. This Committee has now been at work for three years, and has issued three reports, which have greatly added to our knowledge. The reports have attracted considerable attention and interest, both on the practical and the scientific side. Judging from some letters and articles in the Press, many practical men do not clearly appreciate the bearing of the work of the Committee upon the development of the internal combustion motor. Accordingly, this lecture will be devoted to indicating some of the practical points upon which accurate scientific knowledge can help us as engineers desiring to improve internal combustion motors of all kinds.

But first it is desirable to remind you of a few of the leading facts as to gaseous explosions within closed vessels. When a mixture of inflammable gas or vapour and air is confined within a closed vessel and ignited, the act of combustion causes the pressure to increase because of rise of temperature. With a mixture of coal gas and air having just enough gas to consume all the oxygen of the air, the mean temperature at its highest is about 2000° C. The whole vessel becomes filled with flame, which near the cooling walls is at a lower temperature. But at the centre of the vessel, the temperature may be higher by about 300° C. If the mixture be ignited at atmospheric pressure and temperature (16° C.), the maximum attainable pressure is about 100 lbs. per square inch above atmosphere, or 115 lbs. per square inch absolute. If the initial temperature be kept at 16° C., and the density increased before ignition, then double density gives double maximum pressure after explosion, treble density treble maximum pressure, and so on. This has been found to be approximately true up to initial pressures of over 1000 lbs. per square inch by Professor Petavel, of this University.

The temperature of explosion appears to increase slightly with increase of density; but further experiments are required on this point. Reduction of the proportion of inflammable gas present reduces the maximum temperature attained by combustion; and therefore the maximum pressures fall also. At a certain dilution, it becomes impossible to fire the inflammable mixture. The weakest mixture which can be fired by the electric spark gives a maximum temperature of about 900° C.

The rate of cooling of the gaseous explosion depends largely on the capacity of the explosion vessel. Thus in a small vessel of 0·183 cubic foot capacity used in Clerk's experiments, the temperature fell from 1600° C. to under 600° C. in 0·5 second; while in a large vessel used by Hopkinson (6·2 cubic feet capacity), it fell from 1600° C. to just under 1100° C. in the same time. That is, the small vessel lost 1000°, and the large vessel only 500° in the same time.

The rate of cooling also changes rapidly with increased density. Increasing density diminishes the temperature fall in unit time, although it also increases the rate of flow per square inch exposed. This has been fully proved by Bairstow and Alexander's closed-vessel experiments, and by Clerk's experiments within a working cylinder.

The rate of increase of pressure due to combustion depends on the dimensions of the vessel, on the density of the mixture, and on its temperature. Increase of density increases the rate of ignition within limit. Increase of initial temperature rapidly increases the ignition rate, and increase of volume diminishes it.

In large-cylinder engines, it is customary to ignite at two or more points in the combustion space; and even in small rapidly-running petrol engines, double ignition is sometimes adopted. Ignition can be controlled, however, so that the explosion is completed within the range of from one-tenth to one-hundredth of a second. Professor Harold Dixon's interesting investigations on the conditions of ignition in small glass cylinders have thrown much light upon this important question.

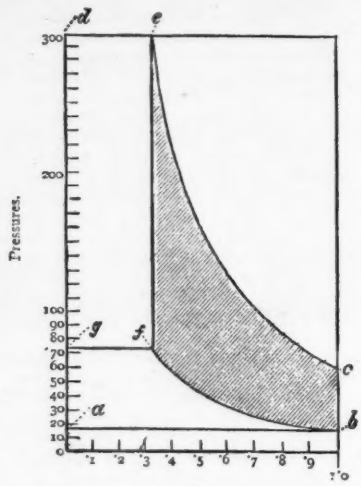
During the period elapsing between the beginning of ignition and maximum pressure, heat is lost to the enclosing cold walls in several ways, which are under experimental examination at present. Heat is lost by convection, by turbulence (due to explosion), and by radiation. During cooling also heat is lost by convection and radiation.

Combustion is now known to be incomplete at maximum pressure; but although much experiment has been devoted to this point, the amount is not yet determined with accuracy. It may account, however, for as much as 5 per cent. of the total heat of combustion of the gas present.

The specific heat of steam and carbonic acid is known to increase rapidly with temperature, and that of air to increase very slowly.

With these facts in mind, the engineer is in a position to consider some of the problems which arise with large and small gas-engines; and accordingly the practical points shall now be considered. [Mr. Clerk showed lantern slides illustrating, by curves and tables, the various points indicated.]

The Institution of Civil Engineers' tests in 1905 proved, among other things, that an engine of about 50 H.P. using coal gas converts practically 30 per cent. of all the heat present in the gas into brake-horse-power; and 35 per cent. appears as indicated power within the cylinder. Professor Hopkinson's experiments at Cambridge have carried the indicated thermal efficiency as high as 37 per cent. for short runs of a 40 H.P. gas-engine, also using coal gas. These efficiencies are very high; but, naturally, engineers still desire to improve upon them. To do this, it becomes necessary to have accurate knowledge as to the disposal of the balance of the heat, amounting to 65 per cent. of the thermal value of the gas. In fact, it is necessary to prepare an accurate balance-sheet of heat given to the engine and heat accounted for in different ways by the engine. Such balance-sheets have been prepared for very many years; but, unfortunately, careful examination has shown them to be unreliable. It is a very difficult matter to determine accurately the division of the balance between, for example, cylinder loss during explosion and expansion and exhaust loss due to heat carried away by the exhaust gases. Fairly accurate balance-sheets are now available; but considerable doubt still exists, which can only be settled by accurate knowledge of the properties of the working fluid.



t absolute temp. °C. at b — p absolute pressure at b
tc " " f — p " " f
T " " e — p° " " e
T' " " c — v°$_o$ volume at b
Here $v_o = v$. — v " " c
— v° " " f

Fig. 1.

The information required to enable a complete balance-sheet to be prepared is best appreciated by considering a gas-engine diagram such as is shown in fig. 1. Assume the compression line B F to be complete; then, to produce the working stroke, heat is to be added to the working fluid at the point F. Assume the pressure to rise from F to E at constant volume. The temperature at the point F is known approximately, and from it can be calculated the temperature at E. It is necessary to know first the total amount of heat required to raise (say) one cubic foot of the gaseous mixture (nitrogen, oxygen, carbonic acid, and steam) from the lower temperature to the upper, neglecting all considerations of chemical action and assuming no heat loss during the temperature rise—that is, we must know the specific heat of each gas through the whole range of the temperature of the explosion. Specific heat for such purposes as discussing gas-engine diagrams is best expressed in terms of mechanical energy necessary to heat up one cubic foot of gas at standard temperature and pressure through 1° C. This cubic foot degree may be called the volumetric heat; and this term is recommended by the British Association Committee.

Three experimental methods have been adopted for the determination of:—

(1) Constant pressure experiments (Regnault, Wiedemann, Witkowski, Lussana, Holborn and Henning). In these experiments the gas under examination is heated from an external source and is at atmospheric pressure.

(2) Experiments in which both volume and pressure are varied; the gas being heated by compression. [Experiments by Clerk, within a gas-engine cylinder, and by Harold Dixon within tubes, belong to this class.]

(3) Constant volume experiments. To this category belong the explosion experiments of Mallard and Le Chatelier, Clerk, Langen, Petavel, Hopkinson, and others, and Joly's determinations with the steam calorimeter.

In the explosion experiments, the gas is heated by internal combustion. The values obtained by the three methods differ to some extent, as will be clearly seen by referring to fig. 2, which shows the results obtained by Holborn and Henning, Clerk, Langen, Mallard, and Le Chatelier, as applied to a gas-engine mixture containing nitrogen and oxygen 83 per cent., carbonic acid 5 per cent., and steam 12 per cent. Holborn and Henning's experiments were only carried to 1200° C. Clerk's experiments are shown to 1200° C., although he measured up to 1500° C., and Mallard and Le Chatelier's and Langen's values are taken to 2000°C. The black line shows the values provisionally adopted by the Committee for the purpose of the first report. It will be seen that for the lower values the black line passes between Holborn and Henning's results and those of Clerk, and for the upper values it passes through the experimental points that were

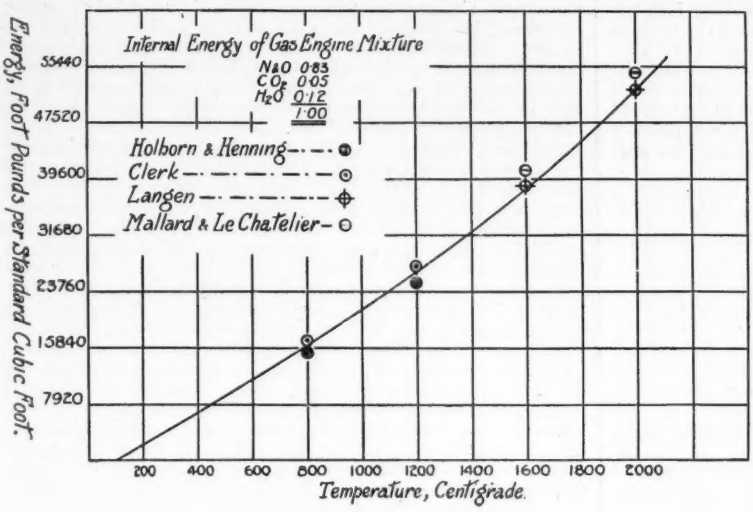


Fig. 2.

determined by Langen. The results of Clerk and Mallard and Le Chatelier thus appear to be higher than the Committee think they should be.

A large part of the work of the Committee is devoted to the discussion of these values; and interesting suggestions have been made as to the cause of the deviation between the different observers. Hopkinson rather favours the accuracy of the lower numbers of Holborn and Henning; while Callendar favours the higher numbers of Clerk. Experiments have been made by Swann and Clerk, by entirely different methods, on the volumetric heat of atmospheric air and carbonic acid at temperatures up to about 100°C.; and these concur within $\frac{3}{4}$ per cent. in both sets of observations, and both give results between 2 per cent. and 3 per cent. above the older standard values of Regnault. The values cannot be taken yet as completely settled; but probably the black line shown on fig. 2 is within 5 per cent. of the true value. As gas-engine mixtures are always dealt with at temperatures above 100°C., the table shows the total energy values of the gas-engine mixture considering the energy at 100°C. to be zero. The values given are foot pounds per cubic foot measured at 760 mm. mercury pressure and 0°C. From this table it is possible to get the energy value of the increase of temperature on the diagram, the line F E, with approximate accuracy. If, then, we know the total heat present in the form of inflammable gas, it becomes possible to say how much heat is lost during the explosion process before maximum pressure is attained, if we assume that combustion is completed at the point E.

Much time and thought have been devoted to this question; and it is now known that combustion is never quite complete at the point of maximum pressure. Experiments made by Clerk and Hopkinson by entirely different methods support the conclusion that, although specific heat of carbonic acid and steam undoubtedly increases largely during rise of temperature, in addition to this it cannot yet be said that combustion is entirely complete at maximum temperature. Further experiments are in progress to determine this difficult point with accuracy; but it is not possible to give definite figures at present.

It has also been found very difficult to arrive at a true solution of the amount of heat lost during this explosion period. Experiments by Callendar and Hopkinson on the radiation loss from flames (Callendar from open flames; Hopkinson from the explosion flame within a cylinder) show clearly that radiation loss has been hitherto under-estimated. It appears probable that a loss of even 5 per cent. of the total heat of combustion may be incurred by radiation during the minute fraction of a second which elapses between the start of the explosion and the attainment of maximum pressure. At the present time, Hopkinson, Callendar, and Watson are all working on this problem.

Neglect incomplete combustion and radiation loss, and consider the simplified problem of heat loss during the expansion or working stroke. If the varying volumetric heat of the gaseous products of combustion be known through the whole temperature range, then an adiabatic expansion line can be drawn from the point of maximum pressure to the termination of the stroke, which will represent truly the fall in temperature due to work done upon the piston. A comparison of this line with the line shown by the actual indicator diagram at once determines the heat loss incurred during the expansion stroke. Even assuming this adiabatic line to be perfectly known, there is still some difficulty in determining the heat loss accurately, because the determination rests upon measurements of relative pressure at the "out" end of the piston stroke when pressures are low; and a small error of the indicator or of reading has a considerable effect in distorting value. Given a perfect indicator and perfect means of measurement, the comparison of the actual line and the ideal line enables heat loss to be determined throughout the whole of the expansion stroke and divided up for each tenth of a stroke.

Another method, however, has been devised of studying the heat loss occurring at different parts of the stroke. Fig. 3 illustrates a new type of indicator diagram which has been used by Clerk to enable the heat loss to be studied within the cylinder. This peculiar diagram is taken by so acting on the valve-gear of the engine as to hold the exhaust valve closed instead of allowing it to open for exhaust at the usual time, and, further, by preventing the charge inlet valve from opening during a series of revolutions. By doing this, when the pressure reaches the point A (fig. 3) the whole contents of the cylinder are retained instead of being discharged; and the piston re-compresses them up to the point B. Expansion then goes on from B to C, compression from C to D, expansion from D to E, &c. In this way, the piston alternately compresses and expands the hot gases contained within the cylinder during a series of revolutions, bringing the volume back to a constant point at each "in" stroke. The pressures indicated at the points B, D, F, H, and J enable a cooling curve to be drawn showing the heat loss throughout the whole stroke at different mean temperatures.

For example, there is obviously a fall in temperature between B and D This fall has been incurred during an "out" stroke, expanding the hot gases from B to C, and during an "in" stroke compressing them from C to D—that is, the loss B D has been incurred during an "out" stroke and an "in" stroke, and each successive "out" stroke and "in" stroke is losing less heat, as is shown by the diminishing distances D F, F H, and H J. By measuring these distances, and allowing for certain work areas, it is possible to construct cooling curves for any part of the stroke, which enable the amount of the heat loss and its distribution to be calculated.

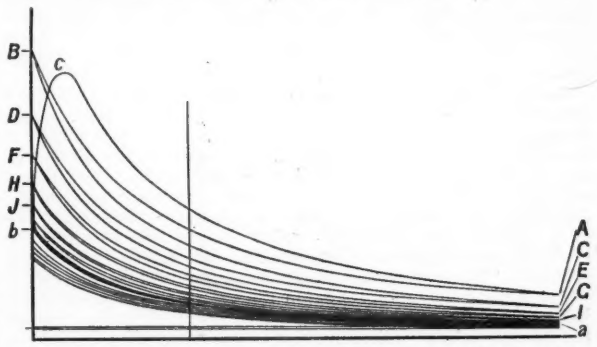


Fig. 3.—Diagram of Explosion and Alternate Compression and Expansion of Hot Gases in Engine Cylinder.

Clerk's earlier experiments were made upon an engine which had a cylinder 14 inches diameter and 22-inch stroke. The exhaust and inlet valve levers were supplied with longer pins than usual, so that the rollers mounted on these pins could be moved into or out of range of the exhaust and inlet valve cams. When each roller was caused to slide to one end of its pin, the cam passed clear of it, and the lever was not operated; when at the other end of the pin, the roller engaged with the cam and the lever operated in the usual way. A spring-and-trigger gear was so arranged that the rollers could be put out of range of the cams at any required instant. By this contrivance the engine could be run in its normal way in accordance with the Otto cycle either at a light or at a heavy load; and any given explosion could be selected for the purpose of the experiment by operating a trigger at the proper moment. By this device, it was possible to run the engine at its normal speed under the usual propelling explosions, and to select at any given moment any particular charge, move the rollers out of the range of the cams immediately the charge entered, and so obtain an explosion and expansion stroke in the usual manner with the usual charge. When the exhaust period was approached, however, the exhaust valve remained shut, as already described; and, accordingly, the hot gases were retained in the cylinder, and compressed by the return stroke of the piston into the combustion space at the end of the cylinder. The energy of the fly-wheel was sufficient to keep up the rotations of the engine (with but little fall in speed) during the short period of observation. The piston was thus caused to move to and fro, alternately compressing and expanding the hot gases contained in the cylinder.

This method of experiment proved that in the ordinary working of the gas-engine the total temperature fall during the expansion was unequally divided throughout the stroke. The temperature fall on the first 3-10ths of the stroke was equal to that incurred on the last 7-10ths of the stroke. These experiments also showed very clearly that, for equal mean temperatures, the heat loss varied greatly throughout the stroke—the higher the density, the greater the heat loss per square inch of surface exposed. Dividing the piston stroke into the first 3-10ths and last 7-10ths for equal

mean temperatures, the rate of heat-flow per square foot per second at the 3-10ths end was proved to be from 2·5 to 2·8 times that obtained for the whole stroke.

It is interesting to compare the temperature fall, due to heat loss, on the complete expansion lines for the whole stroke, and the partial expansion lines for the 3-10th stroke shown by a vertical line on fig. 3. Call the various 3-10ths points on the expansion lines beginning at B, D, and F, as B^1, D^1, and E^1; then the particulars for these three expansions are as follows:—

		Mean Temperature in Time.		Temperature Fall due to Heat Loss.
1	Complete expansion line B C . .	930° C.	..	155° C.
	Partial expansion line B B^1 . .	1190°	..	92·5°
2	Complete expansion line D E . .	690°	..	93°
	Partial expansion line D D^1 . .	900°	..	55°
3	Complete expansion line F G . .	560°	..	65°
	Partial expansion line F E_1 . .	700°	..	31°

In all these cases except the last, the heat loss in the first 3-10ths is greater than that on the last 7-10ths; and the rate of heat flow is very much higher at the "in" than at the "out" end of the stroke.

This investigation is being pursued, and already useful values have been obtained, which enable the engineer to realize the enormous rate of heat flow from the gases at the highest temperature and density to the enclosing walls. This variation in rate fully accounts for the difficulties experienced in preventing cracks at the breech-ends of large gas-engines. To obtain accuracy in these values, it has proved necessary to design new types of indicator. Clerk's earlier experiments on the new diagram were made with a Richard's Casartelli mechanical indicator of the type very commonly used for gas-engine work. His later experiments have been made with an optical indicator.

Other experiments have been made on cooling after explosion within a closed vessel, which show clearly that the rate of heat flow increases with the density, although the actual temperature fall diminishes with increase of density. The effect of increasing the capacity of the containing vessel or cylinder has also been determined. The larger the vessel, the slower is the temperature fall due to cooling; but the heat flow through the walls is increased because the mean temperature maintained is increased. These matters are receiving full attention, and more definite information is being obtained.

So much for the heat loss on the expansion line. The heat contained in the gases before opening the exhaust valve may be determined if the temperature be known. The exact measurement, however, presents similar difficulties to those just discussed; and, accordingly, measurements have been made of the whole heat contained in the exhaust gases by condensing these gases in the calorimeter as they leave the engine. Hopkinson has conducted most valuable experiments of this kind; and in the Institution of Civil Engineers' tests of 1905 a similar calorimeter method was adopted. These experiments, however, proved that the calorimeter method showed less heat in the exhaust than would have been expected from the temperature immediately before opening the exhaust valve. This difference in heat loss was proved to be due to heat leaving the exhaust gases in the water-cooled passage surrounding the exhaust valve—that is, it was proved to be caused by the water-jacket taking heat from the exhaust gases, instead of allowing the whole of the heat to pass on to appear in the calorimeter.

Notwithstanding these difficulties, careful examination of standard tests has proved the balance-sheet of the 14-inch by 22-inch gas-engine referred to to be as follows:

Indicated work	34·6 per cent.
Heat in exhaust gases	49·3 ,,
Heat loss in expansion	16·1 ,,

Similar results were found by Hopkinson in his experiments with another engine using higher compressions. Hopkinson's results showed:

Indicated work	37·0 per cent.
Heat in exhaust gases	42·0 ,,
Heat loss in expansion	21·0 ,,

Knowing the properties of the expanding gases, it becomes possible to find how near we have attained to perfection for the given conditions. Clerk's examination of the same engine proves that had the cycle operated perfectly without any heat loss whatever, the indicated efficiency would have been 39·5 per cent. The actual indicated efficiency was 34·7 per cent.; so that the engine converted 88 per cent. of the heat which it possibly could have converted into indicated work. The complete suppression of all heat losses due to conduction, &c., on the explosion and expansion strokes could only increase the indicated efficiency from 34·7 to 39·5—that is, improve it by about 13 per cent.

From this short examination, it is evident that, so long as expansions remain as at present, no great further increase in the gas-engine thermal efficiency of the internal combustion engine can be hoped for. Increasing expansions means increasing engine weight very largely to gain a small increase in efficiency. It is quite possible to design and construct an engine working with coal gas which would give an indicated thermal efficiency of about 50 per cent.; but such an engine would probably have a lower mechanical efficiency—probably about 80 per cent.—so that the brake efficiency would only be about 40 per cent. It is not likely that such an engine would be commercially successful. The increased first cost would not be justified by the greater economy. Unless some other method can be adopted of increasing power by utilizing the exhaust heat, coal-gas engines are likely to remain at their present standard. The principle of compounding, it is true, might be applied to the gas-engine, and longer ranges of expansion obtained; but such complication will only be justified in comparatively large engines, such as are not likely to be operated by coal gas.

Speaking to gas engineers who are naturally desirous of extending the use of coal gas for motive power, it would appear that their efforts to reduce the selling price of coal gas are more important than those of the engine designer. There seems to be more likelihood of reducing the cost of coal gas to the power consumer by (say) 20 per cent. than there is of increasing the brake efficiency of a coal-gas engine by this amount.

So far as the small gas-engine is concerned, close approach has been made to standard type. Practically all difficulties have been overcome, both from the engineering and the commercial standpoints. Small gas-engines are now even more reliable than small steam-engines, as may be proved by comparison of results given by various insurance companies. Scientific work is more vitally required in the case of the large gas-engine, where the conditions as to temperature, pressure, and unequal expansion due to heat are of the severest kind. Study of the various problems of volumetric heat, heat flow, radiation, incomplete combustion, dissociation, &c., are all required to produce easier conditions of operation while maintaining or increasing thermal efficiency. Inventors of this generation may not succeed in producing sufficiently easy conditions for commercial success in very large gas-engines; but their work, and that of the scientific investigator of the present, will undoubtedly provide the engineer of the future with means of solving problems so far unsolved by the engineer of to-day.

BRICK, CONCRETE, AND STEEL TANKS FOR GASHOLDERS.

By Herbert W. Alrich.

[A Paper presented to the American Gas Institute, October, 1910.]

Since the inception of the gas industry there have been holder tanks constructed of many types and many materials. While there are still tanks occasionally built of unusual design, the practice of the present time is represented most frequently by two types of tank and three materials. Tanks above ground and tanks below comprise the types; while brick, concrete, and steel are the materials. However, these materials are not regarded as being all suitable for either type of tank. Only very unusual conditions could furnish sufficient reasons for placing a large steel tank entirely below ground; and no brick or concrete tank of large size has ever been built without a backing of earth. Hence we may state that the prevailing practice is confined to either steel tanks above ground or masonry tanks below.

The construction of the earlier gasholders required no origination in tank design. Adaptations from existing practice in cisterns were sufficient. An increase in the size of holders accompanied the extended use of gas; and the construction of the tanks was successively identical with the several types of water-tanks of corresponding size.

Until the seventies, the tanks built in this country did not often exceed 100 feet in diameter nor 30 feet in depth. Bricks were as well made as they are now; and were very much cheaper. Bricklayers worked ten hours for $2·50. At the same time wrought-iron plates of the thickness necessary for tanks of suitable depth, more than 60 feet in diameter, were not being manufactured anywhere in the world. The remarkable skill with which cast iron was then applied to structural purposes testifies to the high cost of wrought-iron construction at that time. Under such conditions, the standard tank in this country became a brick pit constructed either entirely below the surface of the ground or with the earth embanked against its outstanding portion. They were generally located upon a site where the ground formation was favourable.

It still sometimes happens that when planning a holder a site may be selected the geology of which is suitable for the type of tank it is desired to build. More frequently, however, we are confronted by conditions which permit little freedom, and dictate the question of the kind of tank there shall be built upon the ground. The different formations that are encountered are too numerous to classify, and often too composite to describe. Among those of frequent occurrence may be mentioned sand, clay, rock, hardpan, and mud. Given any one of these conditions or a combination of them, and the advocates of brick tanks will present their claims.

It is doubtless proper to consider the advantages of any type of tank in favour of which there may be a local sentiment; but the writer is convinced that there is one type of tank superior to all others, and preferable for almost any conditions to be found in the United States. The brick tank seems to be regarded as the criterion of prudence and conservatism; but an examination of these claims does not disclose them as being very well founded. Brick tanks are a survival of an era of non-theoretical engineering when the designing was done by the master mason, with results which, while not dangerously bad, were not economically good. It is true that considerable mechanical reasoning was applied in the

design of these tanks. But this reasoning was not developed in connection with any definite theory of the behaviour of the material; and there resulted no rational mathematical determination of what, and how much, the tanks were expected to withstand. Forty years ago some formulæ were devised for computing the resistance of a masonry tank to the bursting pressure of the water. Very strangely, however, the method does not appear to have been extensively applied until engineering knowledge had advanced past the point where the assumptions necessary to the formulæ were possible to accept.

All engineering structures are subject and liable to the action of forces tending to destroy them. In addition to providing for the proper resistance of the forces a structure is intended to withstand, there must also be anticipated those other forces that may be circumstantially exerted against it.

When force is applied to a structure, there follows, as a result of the elasticity of all materials, a change in the dimensions and a bending of the component parts. The consequence of these deformations is a distortion of the geometric form of the structure as a whole.

If the applied force be continuously increased, the deformations will correspondingly increase until the limit of elastic behaviour of the material is reached, when failure must occur. The elastic properties of all materials commonly used in engineering structures have been extensively investigated for the purpose of establishing the relation between the extension and compression of the substances and the forces whose effects these deformations are. Thus if the forces to which a structure will be subjected and the elastic properties of the materials are known, we may, with reasonable accuracy, foretell the nature and amount of the deformations. Conversely, if we observe the nature and amount of the deformations, we may compute from them the forces acting upon the structure. Or, disregarding entirely the forces producing them, the deformations of a structure may be accepted as an index of its safety.

The distribution of the force applied to a structure among its component parts is somewhat independent of the amounts of material they severally contain. The distribution is influenced more directly by the forms of the parts, and the manner in which the force is applied to them. If the amount of force applied to a structure be considerably increased, there will usually result a change in the manner of distribution. Hence, when designing, the elastic behaviour of a structure must be investigated to determine the extent to which each component part participates in the work of resistance.

This investigation of the effect of force upon matter, or, in other words, of loads or pressure upon a structure, is the theme of analytical mechanics. When applying this science to designing, we have principally to discover the stress or amount of force exerted against each component part of the structure and the relation of this stress to the strain—that is, the shortening or elongation of the component part caused by the stress.

Since the seventies, many brick tanks have been built in this country approximating 185 feet in diameter and 42 feet in depth. The stress conditions existing in a tank of this size will now be considered.

When investigating the strength of a tank, the force we have principally to consider is the effect of the retained water. This hydrostatic pressure produces a state of stress in one of the simplest forms. It is a force acting outward, normal to the surface, and uniform at all points around the entire circumference. If the wall were perfectly elastic, it would become infinitely thin. Thus the nature of the stress is seen to be pure tension, though if the tank be other than truly cylindrical, there will be additional stresses induced by the bending of the wall as the hydrostatic pressure tends to correct the circle.

The resistance of the tank wall is exerted against the internal bursting pressure in two ways, and two only—first, the resistance of the material to the circumferential stretching; and, second, the adhesion of the annular bottom surface of the wall to the foundation. This adhesion to the foundation results in a restraint upon the lower part of the wall, preventing it from expanding in diameter in obedience to the internal pressure. Practical considerations always require a greater thickness at the top of the wall than that necessary to resist the tension. This excessive section materially reduces the diametral expansion at the top. It is similar in effect to the restraint exerted on the bottom of the wall by the foundation. An exaggerated representation of the elastic deformation of the wall is shown in the sketch, fig. 1.

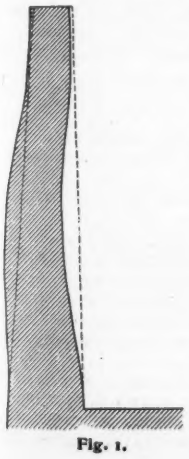


Fig. 1.

Before computing the necessary wall thickness, it is first necessary to determine the distance above the bottom at which the restraint of the foundation ceases to be effective. The exact determination of this distance would involve much calculation. However, with the proportions obtaining in gasholder tanks, this may be taken as a height lying within that on which the total circumferential hydrostatic pressure is equal to the resistance to shearing of the bond of the tank wall to the foundation. As this height is evidently a function of the wall thickness, an assumption must be made.

It will be taken at 12 feet, making the depth from the top of the tank to the plane of the maximum ring tension 30 feet. The shear consequent upon this assumption will now be investigated.

Let—

D = diameter of tank = 185 ft.
h = depth to plane of maximum tension = 30 ft.
H = depth of tank = 42 ft.
S = tension in layer of brickwork 1 in. high.
T = thickness of wall in inches.
U = permissible unit tension.
V = pressure on 1 in. of circumference 12 ft. high.
w = weight of water per cub. ft. = 62½ lbs.

Then—

$$V = \frac{h + H}{2} \quad \frac{w}{144} \times 12\,(H - h) = \frac{30 + 42}{2} \times \frac{62{\cdot}5}{144} \times 12 \times 12 = 2250 \text{ lbs.}$$

This pressure of 2250 lbs. must be resisted in shear by a sectional area of the masonry bond 1 inch along the circumference, and having the thickness of the wall for its other dimension. The writer does not know of the resistance of masonry bond to this form of stress having been experimently determined. However, judging from the ease with which brick may be loosened from the top of a wall of high-class masonry, it is reasonable to consider in this connection the weight superimposed upon the lowest course of brick. In the case of a wall 42 feet high, at 120 lbs. per cubic foot the bottom brick would be under a pressure of 35 lbs. per square inch. If we assume the safe resistance of the bond to shearing to equal 100 per cent. of friction, there is derived for the minimum wall thickness to resist horizontal shear 5 ft. 4½ in. As we would anticipate, the wall having a thickness rather greater than this, the distance of 12 feet may be regarded as a conservative assumption.

Considering next the thickness necessary to resist the ring tension, we have—

$$S = \frac{12D}{2} \times h \times \frac{w}{144} = 1110 \times 30 \times 0{\cdot}434 = 14{,}450.$$

Also—14,450 = TU.

The solution of this last equation requires us to assign a tensional value to brickwork. All the recorded tests of which the writer has knowledge were made in compression. These with a variation of several hundred per cent. compel us to believe that brickwork is one of the most uncertain factors in engineering.

In the designing of the brick tank 285 feet in diameter built at Manchester in 1909, the ultimate resistance was taken as 220 lbs. per square inch. This is the value given by Trautwine for the "average ultimate tensile resistance of brick." The various compression tests have uniformly indicated that brick alone develops a higher resistance to crushing than bricks and mortar. This would seem to be necessarily true in tension, though the writer finds no record of its experimental determination.

The numerous tension tests of 1 : 3 cement mortar indicate an average ultimate unit resistance of 175 lbs. Applying this value and 220 lbs. for brick proportionately to a vertical section of masonry, there results 208 lbs. as the value of the combination.

The New York "Building Code" limits the permissible unit tension induced by bending to 30 lbs. If, however, we avoid a charge of prejudice, by solving for T with U = 100 lbs., there is derived 12 feet for the required thickness of the wall at a point 12 feet above the bottom. This would be unthinkable.

Of tanks approximating the size here assumed, the writer has observed two that were 6 ft. 6 in., three 7 ft., and one 8 ft. thick. If we solve our equation for U taking $\frac{T}{12} = 7$ feet, there results a unit tension of 172 lbs., or 83 per cent. of the probable ultimate. If the tank were slightly elliptical, instead of perfectly cylindrical, there would be an additional increment of tension induced by the tendency of the wall to correct its curvature when subjected to the hydrostatic pressure. This stress would be greatest at the ends of the axes and zero at four points between. The question may be raised as to whether this stress is important. It is certainly safer to investigate than to guess.

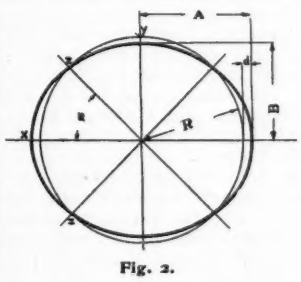


Fig. 2.

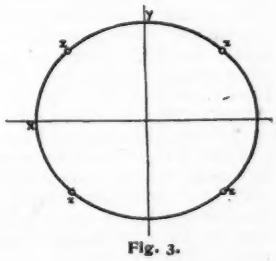


Fig. 3.

In fig. 2, there is represented the elliptical curve to which the tank is assumed to have been built, superimposed upon a true circle of the same perimeter. We know from analytical mechanics that the tension in the shell of any vessel with a curved perimeter, in equilibrium, is P R, in which P = the unit pressure at any

point and R = radius of curvature at that point. From analytical geometry, the radius of curvature at $x = \frac{B^2}{A}$, and at $y = \frac{A^2}{B}$. The tension at x for equilibrium would be $P\frac{B^2}{A}$. The actual tension is P A. Likewise the tension at y for equilibrium would be $P\frac{A^2}{B}$; while the actual tension is P B. Evidently $\frac{B^2}{A} < A$ and $\frac{A^2}{B} > B$. Hence equilibrium can only exist through a correction of curvature which indicates the existence of a bending moment, or internal stress in the wall must resist the bending.

As the radius of curvature of the ellipse passes through all values from $\frac{B^2}{A}$ at x, to $\frac{A^2}{B}$ at y, there is one point at which it equals R. Referring again to fig. 2, if we imagine the ellipse to change in curvature until it coincides with the circle, there is a point Z which undergoes no radial dislocation. Hence this is the point of constant curvature and no moment.

Referring now to fig. 3, we may conceive of the elliptical tank as a system of curved links, pin-connected at the points Z, and acted upon by the uniform internal pressure P. Within the limits of conditions applying to this problem $\frac{A+B}{2}$ varies from R by less than any assignable difference. Also we may determine (from the equations of the two curves referred to as the axes of x and y) that the angle ϕ does not differ materially from 45°.

Taking moments at x, we have

$$P[(\sin\ \phi\ R)^2 - \frac{(\sin\phi\ R)^2}{2} - \frac{(A - \sin\phi\ R)^2}{2} - (\sin\phi\ R)(A - \sin\phi\ R)] =$$

$$P[(\sin\ \phi\ R)^2 - \frac{(\sin\phi\ R)^2}{2} - \frac{\overline{R+d} - \sin\phi\ R)^2}{2} - (\sin\phi\ R)(\overline{R+d} - \sin\phi\ R)] =$$

$$P[0{\cdot}5\,R^2 - 0{\cdot}25R^2 - \frac{(0{\cdot}086R + 0{\cdot}586Rd + d^2)}{2} - (0{\cdot}207R^2 + 0{\cdot}707Rd)] =$$

$P(-Rd - 0{\cdot}5d^2)$ = moment at x.

A similar process shows the moment at $y = P(Rd - 0{\cdot}5d^2)$. Hence the moment at x is negative, tending to send the wall outward and crack it on the inside. It will be observed that the moments at x and y differ only by the value of 2 P ($0{\cdot}5\ d^2$); and this term is plainly negligible. Hence the moment at either point may be taken as P R d.

Assigning a value of $1\frac{1}{2}$ inches to d, the moment at a depth of 30 feet $= \frac{30 \times 62{\cdot}5}{144} \times \frac{12 \times 185}{2} \times 1{\cdot}5 = 21{,}700$ lbs. With $\frac{T}{12} = 7$ feet, then the additional increment of tension = 18·5 lbs., making a total tension of 190·5 lbs. This is 91·60 per cent. of the probable ultimate.

There have now been considered the nature and amount of the stresses imposed upon the tank wall by the internal pressure, and the deformation of the masonry from the resulting strains. It is evident that for a brick tank of large size there must be provided external assistance; for any such thickness of masonry as would safely withstand the pressure unaided is economically impossible.

In the designing of brick tanks, the analysis originated by M. Arson, a French engineer, still seems to be universally applied. This analysis first appeared in a contribution by M. Arson to the "Société des Ingenieurs Civils." It was printed in their "Transactions" about 1870. Dr. Pole translated the article; and Newbigging's works gave it currency. Though the world has constantly been moving since that day, and experiment and reason have been joined to establish theory, masonry tanks are still calculated upon principles which, if followed to their logical conclusion, would result in a wall with twice the thickness at the top that it had at the bottom. "Calculated" we have said—not "designed"; for it would appear that no tanks were ever so built. From this, we may conclude that instinct has prevailed over reason, and spared us the consequences of M. Arson's theory. The knowledge of the mechanics of materials in M. Arson's time was somewhat limited; hence his method disregards entirely the elastic behaviour of the material. By this theory, the pressure is resisted by the moments of stability (taken collectively) of a number of segmental elements similar to staves, of which the wall is conceived to consist, and also by the resistance of the masonry to being cracked down from the top at each end of a diametral line as the tank tended to split through the centre, and each half overturn.

To accept this reasoning would require us to assume that the circumferential stretching is necessarily accompanied by the wall leaning outward about the toe of the base—in other words, that there can be no outward horizontal elastic movement unaccompanied by a bodily upward lifting of the whole wall. The fallacy of this is apparent upon the inspection of any brick wall that has bulged. In fact, we might deduce from the theory of long columns that the weight of the wall could assist in its own destruction.

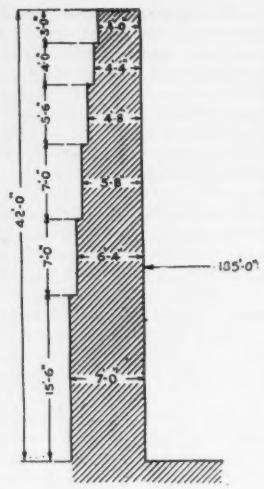


Fig. 4.

Such an analysis was made in designing the large brick tank at Manchester already referred to. The wall was imagined as being subdivided into a number of segmental elements. The summation of the moments of stability of these was assumed as co-operating with the tensional resistance of the ring in resisting the bursting pressure. An examination of the relation of stress to strain under these two conditions of loading will show that their simultaneous existence is impossible.

Fig. 4 is a cross section of the wall of three of the tanks observed by the writer. The average unit tension in a ring at the top 1 foot high $= U = \frac{\left(\frac{w}{2} \times \frac{D}{2}\right)}{12\,t} = \frac{\frac{62{\cdot}5}{2} \times \frac{185}{2}}{12 \times 48} = 5$ lbs.

Let—

E = modulus of elasticity of brickwork.

d_1 = increment of increase of radius—that is, the outward movement of any point in the tank circumference at the top of the wall due to ring tension.

Then—

$$d_1 = \frac{12\pi D \times \frac{U}{E}}{2\pi} = \frac{12 \times 185 \times 5}{2E} = \frac{5500}{E}.$$

If an element of the wall measuring 1 foot along the circumference be now considered as a vertical cantilever, it would first deflect elastically until the adhesion of the wall to the base had been destroyed. This outward bending would not involve the wall being lifted bodily. Taking 208 lbs. again as the ultimate tensile resistance of the masonry, the hydrostatic pressure, F, that the wall can withstand up to the limit of its strength will now be computed.

Let—

I = moment of inertia of cantilever

Then—

$$F = \frac{3U\left(\frac{2I}{t}\right)}{12H} = \frac{3 \times 208 \times 14{,}112}{504} = 17{,}500 \text{ lbs.}$$

The actual total pressure F_1 against the cantilever would be:

$$F_1 = \frac{H^2 w}{2} = \frac{42 \times 42 \times 62{\cdot}5}{2} = 55{,}200 \text{ lbs.}$$

The deflection d_1, at the top of the cantilever, due to the load F, is:

$$d_1 = \frac{F(12H)^3}{10EI} = \frac{17.500 \times 128{,}024.064}{10 \times 592{,}704 \times E} = \frac{379{,}500}{E}$$

The modulus of elasticity of brickwork E is a very uncertain quantity. All attempts to determine it have produced values so unrelated as to be quite meaningless. Fortunately, however, the solution of our problem does not require us to assign to it any value. There have been derived two expressions for d_1. From the ring, $d_1 = \frac{5550}{E}$; from the cantilever, $d_1 = \frac{379.500}{E}$. In both of these E relates to the same mass of masonry; is a common denominator; and may be eliminated. Comparing the numerators, it will be found that the imaginary cantilever would deflect $\frac{379{,}500}{5550} = 68{\cdot}4$ times as much in resisting $\frac{17{,}500}{55{,}200} = 31{\cdot}7$ per cent. of the pressure as the ring would expand in resisting all of it. From this, we may deduce that the extent of this form of resistance on the part of the wall of our tank is $\frac{0{\cdot}317}{68{\cdot}4} = 0{\cdot}00464$, or less than one-half of 1 per cent. of the pressure. In the case of the Manchester gasholder, the proportion is very much less. This cantilever theory contains a fatal defect—it disregards the fact that the curve to which a cantilever deflects when loaded does not, and cannot, coincide with the curve to which a tank is distorted by internal pressure. Fig. 5 is an exaggerated representation of the two curves.

If we imagine a tank built of staves rigidly fixed at the base, the hydrostatic pressure would bend them outward, opening up the joints between. If hoops were then added so as to close up the joints, the staves would be drawn back into the position they

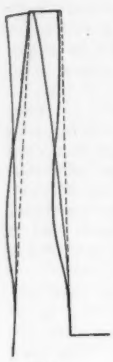


Fig. 5.

originally occupied. The bending in them as cantilevers would then disappear, and the resistance they had offered to the water pressure would vanish with it. The hoops represent the ring tension in the masonry.

The only condition under which the cantilever action is approached is when the wall is made thick enough to reduce its deflection at the top to correspond to the expansion in diameter.

In the case of the Manchester tank, it would have been over 29 feet thick at the bottom. As tanks are built to hold water and not to practice a theory, such proportions are hardly to be contemplated.

The next step in M. Arson's method is to determine the ring tension by assuming a tendency to split the wall down from the top and overrun the halves about a diametral line, as shown in fig. 6.

M. Arson's formula (which is still in current use)

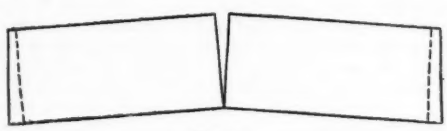


Fig. 6.

for this imaginary resistance is U H^2 T, which he reduced from the form $\frac{H}{2}$ (2 U H T), in which T = thickness of wall in feet. It could be shown that the true expression for this moment of resistance, if it actually existed, would be $\frac{2\ U\ H^2\ T}{3}$; but such computation is unnecessary, in view of the fact that the resistance of the earth to the tank being depressed into it in the manner indicated by fig. 6 would be one hundred times as great. Inspection of fig. 6 will also suggest the relation between the wall thickness at the top and bottom consequent upon M. Arson's theory.

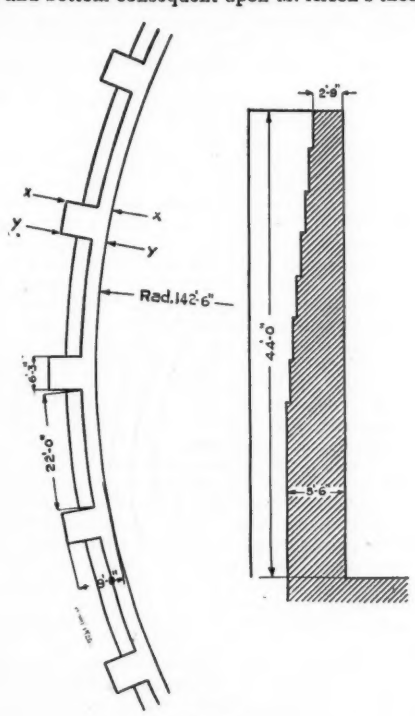


Fig. 7.

Further discussion of M. Arson's formulæ for the resistance of the masonry seems not to be justified in view of Dr. Pole's comment in translating that it is "only an adjunct of minor importance." However, in the calculation with which the method was illustrated 42·5 per cent. of the resistance was contributed by the masonry.

"The real element of resistance is the earth backing," continued Dr. Pole, referring to Arson's formula based upon an assumption that the thrust of the earth against the tank wall has the same intensity at the surface of the ground that it has at the bottom of the well. Since engineers have known otherwise for ages, it is remarkable that such an analysis ever found acceptance. It is astonishing that it is still in use. Does anyone living believe that the uppermost foot of an ordinary sand bank is capable of exerting a horizontal thrust equal to twenty times its own weight?

Arson's formula for the moment of the total earth pressure against the diametral plane = W H (D + 2T)$\frac{H}{2}$ = $\frac{W\ H^2\ (D + 2T)}{2}$, in which W = weight of earth per cubic foot.

Though we should go as far as to regard the earth as exerting full fluid pressure, the moment of its thrust would then be less than seven-tenths of the value deduced by Arson in his numerical example.

Fig. 7 is a vertical section and plan of several segments of the Manchester tank taken from a paper by Mr. Frank H. Robinson, the Engineering Assistant at the Manchester Gas-Works. The paper was printed in the "Journal of Gas Lighting" of Nov. 30, 1909. When computed by Arson's method, this tank had a factor of safety of but 2·5. Mr. Robinson objected to Arson's method because it does not include the additional resistance offered by the adhesion of the base of the wall to the foundation, nor that which he supposed to be contributed by the buttresses. If this be the extent of Mr. Robinson's objections, the remedy is a simple one. It is only necessary to extend Arson's analysis to include them. There is then derived a factor of safety of 2·9 instead of 2·5.

Mr. Robinson's remedy for the low factor of safety was to investigate other stress conditions, under which he deduced a factor of safety of 16. While doing this, he overlooked the necessity of showing that the stress conditions assumed by M. Arson had neither a prior nor simultaneous existence. Until this is done, the factor would remain 2·9. If while investigating the strength of a simple beam which had a factor of safety of only 2·9 against failure in bending, would it add to our sense of security to discover that its resistance to shear was sixteen times that imposed upon it? Right there is the defect in Mr. Robinson's analysis. He considered each panel of the wall included between two buttresses as a dam, overlooking the fundamental fact that it could not so act until it had failed in tension.

An examination of Mr. Robinson's formulæ is more amusing than profitable. They ignore not only the most elementary principles of analytical mechanics, but the laws of Nature as well. These formulæ only deserve our attention because they appear to have been used in designing one of the very largest tanks in the world.

As has been stated, Mr. Robinson analyzed the tank as a series of dams—each segment of the wall included between two buttresses being computed as independently stable. Taking moments about the base, Mr. Robinson assumed the following elements of resistance:

1. Moment of resistance of earth backing.
2. Moment of stability of wall due to its own weight.
3. Moment of shearing resistance through the planes $x - x$ and $y - y$.
4. Moment of resistance of the adhesion to the foundation.

The existence of these elements of resistance in the stability of a dam is fully established; but the formulæ developed by Mr. Robinson for computing their values offend ordinary mechanical instinct. Mr. Robinson repeats Arson's error of assigning the same value to the resistance of the earth-backing at all depths. As such a property does not even appertain to all kinds of rock, it evidently never can be possessed by earth. The acceptance of Mr. Robinson's first equation would require us to believe the uppermost layer of earth 1 inch thick (literally the surface of the ground) would resist a force of 100 lbs. per lineal foot tending to shave it off. A soil possessed of such stability would be a rare and remarkable formation. It could not be excavated by usual methods; it would necessitate the rock drill. The assistance of a brick wall in retaining the water would be unnecessary.

It is only when Mr. Robinson's equations Nos. 1 and 3 are considered in connection with one another that his method is properly appreciated. From equation No. 1 the moment of resistance of the earth pressure against the length of 22 feet (fig. 7) is 25,560,000 ft.-lbs. Hence the moment of resistance of the earth pressure against the buttress would be $\frac{6{\cdot}25}{22} \times$ 25,560,000 = 7,270,000 ft.-lbs. The buttresses, like the wall, also derive stability from the adhesion to the foundation and from their own weight. If these elements be valued (applying Mr. Robinson's methods and unit values as disclosed by his equations Nos. 2 and 4), there results 9,270,000 ft.-lbs. Adding this amount to the stability contributed by the earth backing, or 7,270,000 ft.-lbs., there results 16,540,000 ft.-lbs. as the total moment of stability of the buttresses when computed by Mr. Robinson's methods and applying his unit-values. Now this 16,540,000 ft.-lbs. would measure the entire extent to which the buttress could assist the adjacent wall; but Mr. Robinson's equation No. 3 contemplates an overturning moment more than sixteen times as great, or 276,000,000 ft.-lbs. being resisted by this same buttress! Thus vanishes over 80 per cent. of Mr. Robinson's factor of safety of 16. If we substitute the theories and methods of modern engineering for those of Mr. Robinson, we find that after the tank had failed in tension, it would have a factor of safety against overturning of about 2·5.

(To be continued.)

THE MANUFACTURE OF MIXED GAS.

An article in a recent number of the "Journal für Gasbeleuchtung, by Herr R. Terhaerst, the Manager, and Dr. H. Trautwein, the Chemist, of the gas-works at Nuremberg, raises again the much-discussed question of the relative economy of the manufacture of water gas by: (1) Steaming in coal-gas retorts; and (2) the use of special water-gas generators. The authors refer to the inconclusive character of previous discussions on the question, and proceed to say that their article has been prompted chiefly by points raised in the paper published a few months ago by Herr Debruck, of the Düsseldorf Gas-Works, and in the discussion on that paper [see "JOURNAL," Vol. CX., p. 500].

The authors first say that in the discussion on Herr Debruck's paper, and frequently elsewhere, it has been assumed that there is special difficulty in securing a uniform admixture of water-gas with coal-gas, and that disturbances and difficulties ensue in the use of the mixed gas for lighting and heating, owing to want of uniformity in its calorific value. Such difficulties were supposed to occur when the water gas was made in separate plant, but not when the mixed gas was produced in the working of vertical retorts. How can this different behaviour of the water gas be explained? The water gas is there, and in about equal proportion to the coal gas, in both cases. Doubtless the phenomena complained of may occur if water-gas plant is primarily used to take up the fluctuations in the output of gas in the evening, with the result that for a relatively short time a larger quantity of water gas is added to the coal gas directly in the holder.

Thorough mixing of the two gases cannot be expected from such a procedure, as the requisite time for admixture is lacking. It is conceivable that in such circumstances, when the output of gas is heavy, water gas itself will be delivered directly into the distributing system. These evils are at once avoided, however, if a proportion of water gas corresponding to the make of coal gas from time to time is uniformly and continuously added to the coal gas in the works' mains, and is thus already mixed with the coal gas when it reaches the holder—that is to say, the admixture must take place by day as well as by night. No difficulties or irregularities occur in this method of producing mixed gas; and, as has been already pointed out, it has been adopted for many years. It has the economical advantages that the water-gas plant is fully utilized, and that it becomes possible to add a much higher proportion of water gas without causing more than comparatively small fluctuations in the calorific value of the mixed gas.

The proportion of water gas to be added depends on the calorific value of the coal gas and the required calorific value of the mixed gas. In the first place, care must be taken that the minimum calorific value fixed for the mixed gas (which, in Germany, is usually 522 B.Th.U. gross per cubic foot) is maintained despite fluctuations which may occur or the necessity for occasionally increasing the proportion of water gas added. Supposing that an average calorific power of the mixed gas is aimed at in working, it is naturally important that the burners for lighting and heating should be regulated to correspond to this calorific value of the gas. Considerable fluctuations in the quality of the gas must be avoided, and transition must not be made rapidly from a supply of neat coal gas of relatively high value to mixed gas containing a comparatively large proportion of water gas. It is only fair to the consumers that the proportion of water gas should be increased gradually over a considerable period, and that the necessary adjustment of the burners should be carried out at the same time.

Corresponding to the change in the specific gravity of the gas, the pressure in the distributing system must be increased. If these conditions are observed, an addition of 20 to 30 per cent. of blue, or uncarburetted, water gas—the proportion depending upon the calorific value of the coal gas—is unobjectionable. As to the permissible extent of fluctuations in calorific value, if the burners have been in the first instance suitably adjusted, fluctuations of 5 per cent. in calorific power are quite unrecognizable, while differences of 10 per cent. do not cause any serious change in the behaviour of the gas on combustion in the burners. It may consequently be assumed that wherever disturbances have occurred when separate water-gas plant has been used, there has been also a comparatively great want of uniformity in the quality of the gas, or perhaps a failure to have the burners properly adjusted. In regard to the charge that the addition of water gas causes deposited naphthalene to be loosened and taken up, so as to cause stoppages in mains and service pipes, the fault must in the first instance be assigned to the presence of the naphthalene in the system. For the rest, the taking up of the naphthalene by water gas is as likely to occur whether the water gas has been made in a generator or in vertical retorts.

Herr Debruck, in discussing the relative merits of separate water gas production and of steaming in vertical retorts in the conditions prevailing at the Düsseldorf Gas-Works, refers to the steam requisite for admission to the retorts being produced in a separate boiler heated by the flue gases from the retort-settings. There is thus assumed to be a saving in the cost of steam production as compared with that for separate water-gas plant. It is, however, admitted that this method of obtaining steam jeopardizes the proper control of the retort-settings, which are very sensitive to changes in the working of the furnaces. In the author's view, this point is specially important; and it is worth noting that if the production of steam in this manner causes only a comparatively small increase in the consumption of fuel for heating the settings, such increase may well represent a higher expenditure than the whole saving or economy of steam from an ordinary boiler. For instance, if the fuel consumption is raised by 1 per cent. for a bench of seven vertical retort-settings, the difference will amount to about 25 tons of coke per month, representing, at 28s. per ton, a value of £35; whereas Debruck assumes the cost of steam from boilers to be ⅓d. per 1000 cubic feet of water gas made, which, for the quantity of water gas corresponding to the production from the bench of seven vertical retorts, is equivalent to £6 11s. Thus, it will be seen that if the fuel consumption of the settings is increased by only 1 per cent., the increased expenditure amounts to about five times the cost of the steam from boilers for separate water-gas plant. The difficulties of irregular working of the settings which are likely to ensue from the employment of the flue gases for producing steam are, however, such that there appears to be no prospect of a general adoption of this method of working.

The relative economy of the working of vertical retorts with or without the admission of steam is generally judged on the basis of the yields of gas and of coke and the fuel consumption. If, however, the duty of two different types of setting, or of methods of working, is being ascertained for comparative purposes, the comparison must obviously be made in, as far as possible, similar conditions of working; and therefore the following points must be observed:—

1.—The same description of coal must be used, and its moisture and ash and yield of coke accurately ascertained.
2.—The make of gas and its calorific value, corrected to standard conditions of temperature and pressure, must be accurately determined. The determination of the calorific power is quite as important as that of the make, as the proportion of water gas which may be added depends on the calorific value of the gas. The calorific value of the gas is the chief factor in judging the relative merits of working with and without steam in vertical retorts.
3.—The coke produced and the consumption of fuel for heating the settings must be exactly determined on the basis of dry coke in both cases. The proportion of ash in, or the calorific power of, the coke should be stated.
4.—The amount of tar and ammonia produced should be exactly determined.
5.—The conditions of gasification (such as the weight of charges and the time taken for working them off, the temperature of the settings, &c.) should be exactly stated; and it is desirable also to know the average proportion of carbonic acid in the chimney gases.
6.—The comparison must be made in normal working conditions with the setting or generator giving its full output.

The authors consider that in such a comparison water-gas plant which has been made of large capacity, with a view to its use in the emergency of a strike or of extensions, &c., and is ordinarily not used to its full capacity, should not be wholly charged in considering the capital expenditure; while the cost of benches of coal-gas plant which are out of action in the summer time should be taken into the account. The extent of the reserve and of auxiliary plant must be kept in mind, and its special cost be included. In comparing the duty obtainable in the different methods of working, it is correct to take the cost corresponding to the extent to which the plant is used in the case in question. Having regard to the points just enumerated as essential for the carrying out of a proper comparison between two methods of working, the authors observe that the calculations made in Herr Debruck's paper, being based on a collection of investigations and results obtained in quite different conditions of working and without regard to the exact determination of the calorific power of the gas produced, do not give average values which are of any utility as a basis of comparison. In Herr Debruck's estimates, also, the amount of coke produced has not been exactly ascertained.

It may be interesting, however, to introduce into his calculation the values obtained at Nuremberg in the manufacture of water gas for the production of mixed gas. The interest and depreciation charges correspond to full use of the plant; and the allowance for repairs is the average over the last four years—viz., £90 per 175 to 210 million cubic feet of water gas made per annum. The charges per 1000 cubic feet of water gas made then are as follows: Interest and depreciation at 6 per cent. 0·41d., repairs 0·1d., wages 0·71d., coke 3·61d., steam for generator and fan 0·89d.; making a total of 5·72d. Consequently, 1000 cubic feet of water gas cost 5·72d., or about two-thirds of the cost of coal gas, which was taken by Debruck at 8·28d. Hence the cost of mixed gas becomes lower the higher the proportion of water gas added, and, working as is done at Nuremberg to an average calorific power of 543 B.Th.U. per cubic foot of mixed gas, a proportion of about 30 per cent. of water gas, which is far higher than was taken by Herr Debruck, becomes admissible. The cost of manufacture of the reduced quantity of coal gas required would be somewhat higher; but this increase in cost would be balanced by the lower charges for fuel for heating the settings and the more favourable returns from bye-products. Taking

into account the charges thus established for coal gas and water gas, it would appear that 1000 cubic feet of mixed gas would cost 7·51d., which compares with the cost of mixed gas produced by steaming in vertical retorts, as computed by Herr Debruck, of 7·61d. per 1000 cubic feet. Thus, notwithstanding the cheaper production of steam for the vertical retorts, the cost of the mixed gas remains higher than when special water-gas plant is used. This confirms the earlier conclusions of the authors.

There is still something to be said in regard to readiness for work and reserve capacity of the plant. It has been contended that vertical retorts present a certain reserve of productive capacity and readiness for work at short notice, because with the same time for working off the charge the capacity is increased by about 16 per cent. when steam is admitted. But this increased capacity is based on the fact that when the retorts are worked with steaming 13,855 cubic feet of gas are obtained per ton of coal; whereas when they are worked without steaming, the make per ton of coal is only 11,925 cubic feet. On comparing the figures quoted for the make in vertical retorts with and without steaming, it appears that without steaming seven settings of vertical retorts with ten-hour charges produce in twenty-four hours 953,500 cubic feet of coal gas. On the other hand, 8½ settings of vertical retorts working with steaming and twelve-hour charges produce in twenty-four hours 1,108,000 cubic feet of mixed gas, which corresponds to a make of 912,350 cubic feet of mixed gas for seven settings. It thus appears that, with the same number of settings, the transition from working without steam to working with steam not only affords no advantage in the quantity of gas produced, but actually results in a reduced output of gas.

This fact finds its explanation in the withdrawal of the settings while steaming is proceeding from the work of producing coal gas. In this respect, working with steaming is at a disadvantage as compared with working without steaming. More gas may be produced per ton of coal with steaming, but, per unit of carbonizing plant in the same time, there is a reduction in the output. An increased output would be conceivable only if the steaming coincided to an extent with the time allowed for carbonization as, for instance, if with twelve-hour charges steam was introduced for 2½ hours. But such a method of working appears, according to previous experience, to be unsuitable in regard to the heating of the settings and the fuel consumption. Even in the most favourable case, if the make with steaming is assumed to be 2508 cubic feet instead of 1930 cubic feet higher per ton of coal carbonized than in working without steaming, which would make the output in twenty-four hours 953,500 cubic feet, or the same as when the retorts were worked without steaming, it will be found that the productive capacity remains about 20 per cent. behind that of the retorts together with a special water-gas generator capable of affording the same proportion of water gas for purposes of admixture.

These figures indicate that special readiness for work cannot be attributed to a vertical retort setting, because an increase in the output per setting per hour of 16 per cent. can in no case be assumed as obtainable. As regards flexibility of working, it is to be observed that a water-gas generator can be made ready for work in two hours at the longest; whereas six days are required to bring a setting of vertical retorts into working condition. While working with steaming appears the most advantageous method on technical grounds of operating vertical-retort settings, nevertheless, in regard to economy, flexibility, and readiness for work, it remains undoubtedly at a disadvantage as compared with the manufacture of mixed gas with special water-gas plant. The results here discussed refer to settings of twelve vertical retorts; and it remains to be seen to what extent they are affected when the change is made to settings of eighteen vertical retorts, which evidently present more favourable carbonizing conditions, especially in regard to the maintenance of the heats and the consumption of fuel. Results published hitherto in regard to the working of these settings, however, are incomplete, in that they do not give exact figures either for the production of coke or the results obtainable when the settings are worked without steaming.

The London and Southern District Junior Gas Association will visit the Brentford Gas-Works next Saturday afternoon; two later fixtures are also announced. On Friday afternoon, the 25th inst., the works of Messrs. W. Sugg and Co., at Regency Street, will be inspected; and in the evening of the same day, at the Westminster Technical Institute, Dr. Harold G. Colman will lecture on "Some Applications of Gaseous Combustion."

Thorianite in Ceylon.—In the course of a report just issued by the Colonial Office, Professor Wyndham Dunstan, the Director of the Imperial Institute, says: "The initial stage of the work of the Mineral Survey of Ceylon may now be regarded as largely completed. It is clear the island contains, in addition to gem stones, a number of minerals of commercial importance, of which only graphite, mica, and thorianite are at present worked. . . . Thorianite is a new mineral discovered as a result of the operations of the Survey, and so far not known elsewhere than in Ceylon. Comparatively large quantities have been profitably exported in recent years and utilized in England as a source of the thoria used in the manufacture of the incandescent gas-mantle. Much remains to be done in discovering new localities in which this mineral is present, and also in devising better methods of recovering it from river beds and alluvia in which it is known to occur."

PROTECTION OF GAS AND WATER MAINS FROM DESTRUCTION BY ELECTRIC CURRENTS.

The "JOURNAL" for Aug. 28, 1906 (Vol. XCV., p. 578), contained a summary of a lengthy report by Dr. F. Haber, Professor at the Technical College at Carlsruhe, on vagrant electric currents in the streets of the town, and their effect on the gas and water pipes. A plan of Carlsruhe was given, showing the tram-rails and water-mains in the chief streets of the town, and the fall of potential observed at a number of test points. An article by Herr Geppert and Dr. Liese, of Carlsruhe, has been published in a recent number of the "Journal für Gasbeleuchtung," describing investigations which they have made on the mains in part of the district referred to in Dr. Haber's report in 1906. Since their observations, following on Dr. Haber's exhaustive examination of the conditions prevailing in Carlsruhe, elucidate certain points of general application in regard to the damage done to gas and water mains by stray electric currents, and present a method by which damage may be avoided, we give to-day a summary of their paper.

Dr. Haber showed that the mains in the Durlacher Allee, in the neighbourhood of the electric generating station, were exposed to great risk. Actually, various fractures of the smaller mains, about 4 inches in diameter, have occurred in recent years. The larger mains of 10 and 12 inches diameter running near the tramways in the Durlacher Allee and Tullastrasse [see plan in "JOURNAL," Vol. XCV., p. 579] were examined from time to time, and fractures were avoided by renewing the mains or taking other preventive measures as soon as their condition required it. Thus, in July, 1906, a 12-inch gas-main crossing the tramway in the Durlacher Allee was found to be strongly corroded at the crossing point. The main was carefully insulated where corrosion had occurred by a thick layer of bitumen wrapped with tarred jute, over which was another layer of bitumen; and where the corrosion was particularly great, the main was strengthened by heavy wrought-iron bands. The main was laid bare again for examination ten months later, and there was found to be heavy fresh corrosion to the right and left of the parts insulated the previous year; so that it became necessary to extend the insulation. In the years 1908 and 1909, a stretch of about 210 yards, in which the gas and water mains were in danger, was protected by a new electrical process which will be described.

Mains are destroyed by electrolysis through the current which passes from them through the earth to the tramway rails. This destruction occurs only when the body from which the current issues acts as the positive pole and is attacked by the oxygen formed by electrolysis. Current which enters a body acting as the negative pole protects it through the hydrogen which is evolved. It is clear, therefore, that pipes will not suffer destruction in the ground if the current is prevented from passing from them or if the current passes into them. The method of protection recently adopted at Carlsruhe secures this effect by means of electrodes which are sunk in the ground at suitable places near, or parallel to, the mains. These electrodes are connected with the positive pole of an accumulator or dynamo giving a low voltage current; while the mains are connected with the negative pole of the same source of current. Provided the potential, which need only be quite low, is sufficient, a current flows from the electrodes through the ground to the mains, and prevents the working current of the tramways passing out of the mains and so destroying them by electrolysis. The effect is to reverse the direction of the current which in unprotected mains passes out of them. The action may be compared with that of a stream of water. If water is flowing from right to left in a pipe, and the left end of the pipe is connected with a main in which the water pressure is higher than that in the pipe, it is clear that water will flow from the main into the pipe and, expelling the water already there, will set up a reverse flow of water in the pipe. It is the same with the current which normally passes from a main into the ground; but when the electrodes referred to are installed, a higher electrical tension is produced in the ground, and the direction of the current between the main and the ground is then reversed.

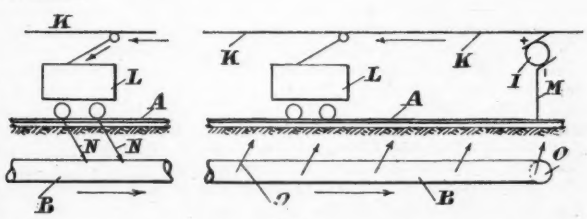


Fig. 1.

The method of protection depending on the foregoing principle is applied in the following manner. The diagram (fig. 1) shows a tramway in which the electrical method of protection has not been adopted. The working current passes from the dynamo I at the generating station through the overhead conductor K and the tram-cars L to the rails A, and returns through them and the conductor M to the dynamo. But part of the current—viz., the stray or vagrant current—passes from the rails through the earth

in the direction of the arrows N to a gas or water main B, which, running parallel to the rails, forms a good conductor of the current towards the dynamo I. In order to reach the latter, however, it passes in the direction of the arrows O back to the rails and through the conductor M to the dynamo. It is at the points O, where the current leaves the pipe, that the latter is exposed to electrolytic destruction.

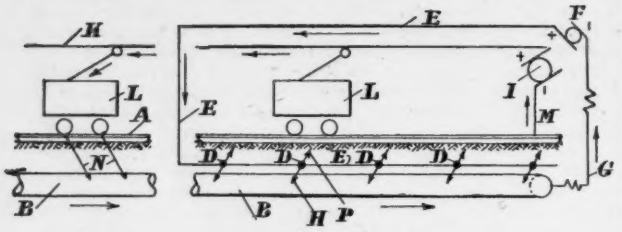


Fig. 2.

Fig. 2 is a diagram of the same system with electrical protection. The electrodes D, sunk in the earth near the main B, are connected by the conductor E with the positive pole of a source of electricity F, the negative pole of which is connected by the conductor G with the main B. Current passes in the direction of the arrows H from the electrodes D in the reverse direction to the vagrant current indicated by the arrows O (fig. 1), and suppresses the latter and thereby protects the main B from corrosion. The portion of the working current of the tramway which enters the main at N passes through the conductor G to the source of electricity F, and thence through the conductor E to the electrodes D, and from them, in the direction of the arrows P, to the rails A, and so to the dynamo I at the generating station. Thus the vagrant current finds its way back through the electrodes D to the dynamo; and it is these electrodes only, and not the main B, which are exposed to electrolytic destruction. It is an important incident that opportunity is afforded for the stray portion of the working current to find its way back readily to the dynamo at the generating station.

When pipes are protected by insulation with bitumen, &c., the electric current is prevented from passing from them at the insulated stretches, with the consequence that it passes in greater measure from the portions of the mains adjacent to the insulated stretches. The insulation with bitumen, &c., at Carlsruhe has not proved adequate; for wherever the insulation was in the least degree faulty, current escaped and caused destruction of the main. The insulation has indeed been harmful in that adjacent non-insulated mains have been more strongly attacked. The protecting electrodes may be either set at intervals in sockets made for the purpose in the ground along the course of the main to be protected, or one or more continuous electrodes may be laid parallel to the main. For these continuous electrodes, disused cast-iron gas-pipes of small diameter with good run-lead socket joints have proved satisfactory conductors for the protecting current. Measurements showed that the resistance of a joint in a cast-iron pipe of 60 m.m. (2¾ inches) diameter was as follows: With a run-lead joint, 0·00033 ohm.; with a lead-wool joint, 0·01 ohm; with a screw socket joint, 0·00066 ohm. The electrodes set at intervals need a rather higher tension current for the proper protection of the main than does the continuous electrode laid parallel to the main. The tensions or falls of potential when protecting electrodes are used at intervals are shown in Table I., which represents the conditions when the tramway is at work:

TABLE I.

Number	1. Volts.	2. Volts.	3. Volts.	4. Volts.
Fall of potential between the electrodes and the main	0	+2	+4	+6
Fall of potential between the main and the immediately adjacent soil:				
Measured at the top of the main .	+0·45	+0·11	+0·07	−0·11
Measured at the bottom of the main	+0·35	+0·03	−0·01	−0·19

It will be seen that when the fall of potential between the electrodes and the main is *nil*, the main is strongly positive relatively to the earth, and is not protected. But as the fall of potential between the electrodes and the mains is increased, the main changes from positive to negative towards the earth, and at 6 volts fall of potential between the electrodes and the main the latter is strongly negative relatively to the surrounding earth. Complete protection of the main would be afforded with about 5 volts tension in the electrodes. Table II. gives similar figures for two continuous electrodes laid parallel to the main:

TABLE II.

	Volts.	Volts.
Fall of potential between the electrodes and the main .	+2	+4
Fall of potential between the main and the immediately adjacent soil:		
Measured at the top of the main	−0·05	−0·45
Measured at the bottom of the main	−0·35	−0·95

It will be seen that complete protection of the main is afforded with 2 volts tension in the electrodes. The tension to be given to the electrodes in any case is determined not only according to the working conditions of the tramway and the main relatively to the rails, but also according to the conductivity of the soil, which can be easily determined by measurement. The power required is quite inconsiderable in relation to the power needed for working the tramway. At Carlsruhe, this method of protection has been applied in the neighbourhood of the generating station to about 110 yards of water-main of 10 inches diameter, about 22 yards of gas-main of 12-inches diameter, and about 77 yards of high-pressure gas-main of 6-inches diameter. The current consumed for protecting these mains amounts to about 11 ampères at 10 volts tension or 0·11 B.T. unit. This current is generated by a small electromotor at the generating station coupled to a low voltage continuous current dynamo which works from six o'clock in the morning till midnight.

The apparatus is provided with a recording volt and ampère meter. The current is conducted to the electrodes by wires carried overhead on the tramway standards. Insulated wires pass from the wires at the standards to the electrodes in the ground. On the standards at suitable places are small boxes with adjustable resistances, by means of which the proper tension is given to the different electrodes, and needlessly high consumption of current is avoided. The connection between the negative pole of the dynamo and the mains is made by means of the gas and water service pipes in the generating station. The electrodes used have been in some cases iron rods, and in other cases, as already explained, old cast-iron pipes. Practical proof of the efficiency of the method of protection is afforded by the case of a 12-inch gas-main which crossed the tramway in the Durlacher Allee. In July, 1906, and in May, 1907, this main was insulated, and in ten months' time was found to be strongly corroded. The main was renewed in April, 1909, and protected by the electrical method. In July last, it was examined and found quite free from corrosion even at the joints, where corrosion is most readily detected. It is thus evident that the method had afforded complete protection over a period of fifteen months.

The authors refer next to the manner in which pipes are corroded by electrolytic action. In addition to deep pittings, there are holes right through the pipe which, however, when the latter is bared, are found to be filled with a soft and easily perforated graphitic material. This material prevents gas escaping freely; but when the ground is opened, there is a strong smell of gas and the earth for a considerable distance is coloured green, and has the well-known smell caused by gas leakage. When the bituminous insulation formerly used was removed from pipes, there were found to be numerous fresh cases of corrosion. In some instances, these occurred where the pipe had been indented with a chisel. Water-mains, which it had been found necessary to renew, were deeply corroded and evidently would have given way in a short time, with the result that not only the water supply but the tramway traffic would have been interrupted.

The gas-mains, though not actually fractured, were a source of danger owing to their unsoundness, as the escaping gas, especially when the ground was hardened by frost, would readily penetrate into the adjacent houses. Examination of the mains showed that they were corroded on all sides, and not merely on the side turned towards the tramway rails. The rails themselves in some cases were strongly corroded, and the method of electrical protection could naturally be applied to them also. But corrosion is of relatively small importance in this case, as the rails can readily be renewed. The electrical protection, however, should be of service in the case of bridges, iron tunnels, conduits, cables, &c. It may be applied locally to the portions of the distributing system which are most exposed to danger of corrosion, and it has the advantage over insulation and other suggested methods of protection that it returns the stray portion of the current to the dynamo at the generating station, and does not merely transfer it to another portion of the distributing system. Insulation of the main, on the other hand, merely results in adjacent lengths becoming more strongly corroded.

The details of the method of protection described are embodied in a German patent (No. 211,612) granted to Herr Geppert.

The Visit of German Gas Engineers to Edinburgh.—At the meeting of the Edinburgh and Leith Gas Commissioners on Monday last week, a letter was read from Herr Prenger, in which he conveyed the thanks of the members of the German Association of Gas and Water Engineers who recently visited the Granton Gas-Works for the kindness they received. The works had, he said, made an impression upon them which would dwell in their recollection.

Southern District Association of Gas Engineers and Managers.—The general meeting of the Association will be held on Thursday afternoon, at the Hotel Cecil, Strand, under the presidency of Mr. C. Stafford Ellery. According to the circular issued by the Hon. Secretary (Mr. W. E. Price, of Hampton Wick), the business will include the election of the President, Vice-President, and officers for 1911, also new members. The President will make a statement on the subject of the Benevolent Fund of the Institution of Gas Engineers; and three papers will be submitted. Mr. A. E. Broadberry will deal with "High-Pressure Lighting;" Mr. P. G. G. Moon with "Sulphate Manufacture for Small Works;" and Mr. T. Price with "District Pressure."

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Monthly Meeting of the Western District Division of the Scottish Junior Gas Association was held in Glasgow on Saturday last. The PRESIDENT (Mr. J. Frazer, of Provan) occupied the chair; and there was an unusually large attendance of members.

Mr. GEORGE SCOTT, of the Meter Department of the Glasgow Corporation, read a paper on

THE REPAIR OF GAS-METERS.

The author commenced by saying the subject he had chosen might appeal to some more than to others, by reason of the fact that very few gas undertakings in Scotland conducted the repair of meters in their own workshops; but he was satisfied that this could be done more efficiently, more practically, and perhaps more profitably than by employing outside agencies. At the same time, he was not there to dispute as to who were the best people to repair gas-meters, but to describe the best means to facilitate the repair; and as the wet meter was a thing of the past in Glasgow, his paper would be devoted principally to the repair of the tin-cased dry gas-meter. After giving a few particulars as to the arrangements of the Corporation workshops, the author proceeded as follows.

All meters, as they are brought in from the districts of supply by the fitters, are received by the Meter Department the following morning, together with a sheet giving the maker's name, a description of the meter (whether wet or dry), the number of lights, Corporation number, dates of purchase and of last repair, and, of course, the defect. An adhesive ticket is gummed on the side of each meter, giving the fault for which it is brought in. Each maker's meters are kept separate and arranged in sizes to facilitate the checking by the recording clerk and initial tester, whose duty it is to see that the Corporation number and the reading of the index are correct. They are then laid aside so that they may be tested at the same temperature as that of the workshop. All meters when brought in should have the outlet and inlet corked to prevent the action of air on the diaphragms, or any dirt on the valves from solidifying, for by this means the inside of the meter is kept very much in the same condition as when it left the consumer.

The initial or first test is to find out the defect. The testing apparatus used for this is three 5-feet holders and two long tables with 26 wet meters, each having connections to allow a one-light to a three-light dry meter being connected and the one meter run against the other. The one-foot cylinder on the top of the wet meter index is removed, and a round plate with movable pointer substituted. Another pointer is attached to the wet meter index-box which is stationary, to allow of the movable pointer being brought into line with the stationary one. The round plate is divided into one-foot or 100 cent.; the tenths also being marked. The test-table is supplied by a 1-inch iron pipe, and controlled by a governor set to give 7-10ths of pressure. Meters are tested for indication, drawing lights, back-flame, &c. Should a special test be desired by the Surveyor's Department, owing to a disputed index or gas account, the 5-feet holder only is used. All 5-light and 10-light meters are tested by the holders. So far I have dealt with the largest quantities of meters brought in. A special tester is reserved for 20-light up to 500-light meters; the latter being the largest size of meter on the districts.

In testing a meter for escape at the index, it is well to use the sense of smell before applying a light, as this part of the meter often contains an explosive mixture of gas and air. By piercing a small jet hole at the top corner of the meter, the danger of having the glass or index blown in one's face can be lessened. Meters measuring slow have very often dirty valves, covers lifting, or bent valve wires or arms. Those measuring fast with back-flame have porous diaphragms. The result of the initial test is marked on each meter, then copied on to the sheets, and in due time filled into the meter register. They are now passed on to the washers to have their outside case cleaned; this making it easier for the foreman to make his selection of the different kinds of jobs. After the meters have been selected, they are built up in rows with the back dates to the front; and each meter when being placed into a job has the Corporation number and the date when brought in for repair put on the workman's line. These meters are placed in boxes to hold six each; the boxes being numbered from 10 to 99. Thus the jobs are placed ready to be given out when required.

We now proceed with the repair of the meter by removing the Government stamp, scraping the paint off the soldering round the top, and piercing two holes in the side (keeping clear of the division), to allow the condensation or liquor to be drained off into the pan used for the purpose. This is thrown out, and the dish washed with warm water and soda. The top is then removed, care being taken that no solder is allowed to run in upon the index. The brass pin is next taken out of the tangent, allowing the valve-plate to be removed with greater freedom. The nuts are taken off the valve-pins and placed on the tray; the repairer marking his initials on the left-hand corner of the meter, and numbering each of them from No. 1 to No. 6. The top and valve plates are marked similarly, so that all may go back to the same meter. If after opening it is discovered that a meter is damaged by damp, it is submitted to the foreman, who decides the nature of repair necessary. The upper part of the meter, containing the two slide-valves, conveys the gas to the several chambers; and it is a very important point that they should be absolutely tight, to ensure that the meter works steadily, and also that no unregistered gas may pass through. We therefore hand them over to our grinders to have the valves ground. By bending the front valve wire up or the valve-guide down, it gives freedom to face the cover and grating together.

The meters are now passed on to the sounder, whose first duty is to examine the nipples, and make sure that they are to the standard size. All 2-light nipples are taken out and replaced with new ones; the thread fitting a 3-light ring, and the tail fitting the 2-light socket. The sounder observes the general condition of the meter; the date of purchase or of the last repair guiding him as to the length of time the meter has been out. He also sees that the top arms have plenty of stretch. When satisfied that all is in good order, he gases the meter. To do this the meter must be worked backwards (owing to the valve-plate being worked off), by connecting the supply to the outlet. The flow of gas being stopped by the back-check, by observing the holder to see if it is travelling a good idea is formed of whether the diaphragms and valves are tight or leaking. When sufficient gas is passed through the meter, the touch-light may be used in the smaller-sized meters to locate escapes in the chambers, diaphragms, or valves. If the meter passes this test and is found good, it is duly returned to the repairer marked "R." Meters found defective are marked "L.D." (meaning leaking diaphragms) and returned to the repairer for a general overhaul. A meter repairer has always two jobs on hand; and while he is proceeding with the general repair of one, the other is with the grinder and sounder. He is held responsible for each meter to the finish of the repair. He takes the valve-covers out, placing them on his tray, scraping the paint off the soldering round the backs and fronts; and, using a very warm soldering-iron, he runs the solder off, inserts a sharp blade at the corner, and the backs and fronts of the meter come off easily. These are initialed and numbered the same as on the left-hand corner of the meter. He then wipes out any loose liquor in the bottom of the meter, and tins the edges well. This is found to be beneficial when putting the meter together again. They are next thoroughly washed out with crude naphtha and dried with coloured waste. The diaphragms are then sounded by placing a piece of putty over the port leading to the inside, and pressing the disc. If there is a small leak, the repairer will hear it blowing; and should the escape be difficult to locate, by putting water into the inside he will observe it at once by the bubbles. If the leak be in a favourable place, the parts can be drawn together by a silk thread. The gas-ways are now sounded by putting a piece of putty over the two centre ports and sucking the outlet. By placing the thumb over the hole in the centre of the valve-box and sucking the inlet, the repairer will discover whether or not the gas-ways are tight. If satisfied that all is correct, he makes an incision in the disc to admit a 3-inch circle being cut out; or, if it has been opened before, he has the circles run off with the soldering-iron.

The diaphragms are oiled from the inside with black lead and oil—the oil to soften and preserve the leather; the black lead to fill up the pores. There are great differences of opinion among meter makers as to what is the best oil for this purpose. The mixture we use is from the recipe of the late Dr. Russell, the City Analyst; and it has proved most satisfactory for more than twenty years. It is made up as follows: Palm, 1 qr.; olive, 1 cwt.; racked cod oil, 1½ cwt. The palm oil is well heated, and then mixed with the other oils. It is given out to the men in ½-gallon tins, with ½ lb. of powdered black lead well stirred through it. This is well rubbed into the leather by means of a swab. The meter is then laid on its back to allow the oil to be absorbed well into the leather.

Attention is now given to the meters. All surplus oil is lightly dipped out with a piece of loose waste, the inside of the diaphragms thoroughly cleaned out, going well up into the tongue leading to the inside, and making sure that no oil is left which might be blown up on the face of the valves. The tin circle is soldered on to the disc, the meter laid on its flat, the two rims of the diaphragms placed directly on top of each other, and the hinge-piece placed in its proper position and soldered on to the circle again. The workman puts the putty on the valve-grating, and observes the top arms to see if there is any movement. Should there be an escape, it is at once located. If unrepairable, it is shown to the foreman, who gives the workman permission to replace it by a new one. The meter is now cleaned out round about the outside of the diaphragms; attention being given to the flag wires, motion wires, hinges, and studs. If all is in good working order, we are ready to tack on the backs and fronts; and we proceed with the soldering-up, taking care to make a good job of the corners, to prevent any escape from this point.

We next give our attention to the top portion of the meter, by cleaning the valves and replacing the covers. The meters are then submitted to the foreman for the inspection of the cranks, valve-arms, and valve-pins. If found defective, the valve-arm is bent up, signifying that they are to be taken out and replaced by new ones. The stuffing-boxes are next cleaned out and repacked with new wool prepared with the best Russian mutton tallow; and a leather washer is put on the top and bottom of the packing. They are next of all neatly cleaned with whiting; a pair of bellows

being used to blow out all the loose dirt or whiting. The brass fittings are cleaned with aqua fortis; and all soldering parts are re-tinned. The index is examined and wound up to zero; and the tangent pin loosened from the tack of solder. They are now ready to be replaced in the meters and examined by the foreman. This final examination is to see that the valves are equally divided, the index adjusted and placed in its proper position, the spindle running free and in gear with the worm, the top arms divided by the tangent pin, and the rod wires well packed and able to bear their own weight when lifted without dropping again. They are then passed on to the sounder again, who gases and goes over them with his touch-light, as in the previous sounding test. Finding all in order, the meters are marked with an "R," and handed back to the repairer to have the valve-nuts and valve-plates put on. The repairer's line is now filled in, and opposite the number of the meter he describes the nature of repair, the material used, and the total time he has taken to do the job. This is subsequently entered in the time and material register book by the recording staff.

The meters are now passed on to the final testers, who work in threes—two proving with gas, and one measuring with air. Although they have been examined and the valves divided as nearly correctly as the human eye can make them, the prover's first duty is to run them with ½-inch pressure; making sure that the flag wires and the cranks are properly packed. When he is perfectly assured that everything is right, the top arms are tried to see that they are equally divided and running in unison with the valves. The lights going out at the four points of the tangent proves that the four chambers are perfectly tight, and there is no possibility of gas passing from one chamber to the other. A pressure of 4 inches is put on, and the meters carefully gone over with the touch-light to search for escapes; and if any are found, the meter is returned to the workman to be made good. The variations are now taken out by passing half a cubic foot of gas through, first at ½-inch pressure, and then at 4-inches pressure. If all is well divided, the bearings working smoothly, and there is no collapse in the diaphragms, both the readings should come out very close. The meter may prove to be a little slow on the high pressure, but never fast.

The meters are next passed on to the measurer, who brings the tangent to a point, and, according to the size of the meter, takes a few revolutions against a pointer placed inside. If fast, the tangent pin is drawn out; if slow, it is pushed in. The pointer on the foot circle being set to a given place, and the holder adjusted, he runs the complete 2 cubic feet. When the meter is found to be reading correctly, a tack of solder is given to the tangent pin to keep it from shifting, and a small brass pin inserted into the tangent pin to prevent the top arms from coming off. The meters are now ready for the topper, who solders on the top and seal cup, and also puts leather washers on the couplings. They are then returned to the testers, and gassed and tested for escape at the index. Then the couplings are reversed, and the meters are tested to see if they will go out at the back-check. The prover now fills in his portion of the workman's line—the date when the meter was proved, and by whom. It is passed on to the painter, to be coated first with quick-drying paint. The date when it was last brought in is painted on the inside of the index-cover, for future use if required in tracing the history of the meter. It then receives a second coat of paint, and is allowed a night to dry; and next morning it is sent to the Board of Trade stamping office.

At this point we complete our work with regard to the meter. But it may not be out of place to give a few figures regarding the amount of work that has been accomplished in this department during the past financial year, beginning June 1, 1909, and ending May 31, 1910. We began with 10,440 ordinary and 283 prepayment meters in stock. We received from the districts for the year, 26,245 ordinary and 9091 prepayment meters; making a total of 46,059 meters in stock. Of these, 11,051 were found good and repainted. We repaired for the year 18,704 ordinary and 1956 prepayment meters. We also altered from ordinary to prepayment 1110 meters; making the total of repairs for the year 32,821. Of the total meters in stock, 5982 were found to be unfit for repair, and were condemned. The new meters received from the makers for the year were 1966 ordinary and 5686 prepayment —a total of 7652. All these were examined and badged, and then sent to the repaired meter stock. The average number of meters repaired and repainted was 631 per week. The faults usually found in ordinary meters are "drawing lights," "fast," "slow," "not indicating," "bound and damaged." The faults usually found in prepayment meters are "cases damaged," "cash-boxes damaged," "lamps and hasps damaged," "valves not closing," "valves not opening," and "prepayment gear broken."

Before concluding, I should like to say that in the case where a meter is brought in from the district, and after being examined is found to be unrepairable, it is the foreman's duty to condemn it. It is usually taken to pieces, and all the parts found good are cleaned and utilized for repairing purposes on some other meter. I should like to add that a gas-meter is undoubtedly one of the most interesting, yet mystical, apparatus in existence. But with a little careful study of the index, no consumer need be in any difficulty; and with a little attention to this matter, he ought to see at a glance the quantity of gas consumed. Instructions for this have been printed on all gas account forms; and I may state that invariably the recording of the index is absolutely correct. If the citizens of Glasgow, whose gas is measured with such scrupulous exactitude and impartial fairness, enjoyed the same advantages under the administration of weights and measures in dealing with the food of the people, what a boon it would prove to the whole community.

Discussion.

The PRESIDENT, in opening the discussion, remarked that it said a great deal for the Meter Department of the Glasgow Corporation when they could repair 631 meters per week. If what Mr. Scott had said about the proving of a gas-meter were known to consumers, there would be less grumbling among them about the inaccuracy of their meters.

Mr. J. GRANT (Glasgow) said he thought that to Mr. Scott the thanks of the meeting were due for his very interesting paper. Perhaps some might be disappointed because the paper had been confined to the repair of dry meters; but to him (Mr. Grant) this subject was a very broad one, on which there was room for half-a-dozen papers. More attention should be paid to gas-meters than was usually the case. Any place—the darkest in a house and the dampest in a shop—was considered to be good enough for a gas-meter. The majority of gas-meters were in tin cases; and when they were put in a damp place corrosion was bound to set in, and in a very short time escapes occurred. He had known cases in which meters had been out for only a twelvemonth—300 and 400 light meters, costing from £25 to £40—and had been completely wrecked. He had heard of a self-oiling meter, in which a supply of oil was kept continually flowing on to the diaphragm by means of small woollen wicks, which were supposed to be sufficient to syphon enough oil to keep the diaphragm moist; but to his knowledge this was not the case. Sufficient oil might be carried from the tables on to the top of the diaphragm, but would the diaphragm absorb it? To his mind it would not. He had proved it several times. In their works they had tried to oil the diaphragms entirely from the outside, but had failed.

Mr. J. WILSON (Falkirk) asked if the meters came in to be repaired as a result of complaints by consumers, or if there was a periodical repair of the meters. If the latter, how many years were given to a meter before it was repaired? The meters which were condemned had badge numbers put on, he presumed, by the Corporation themselves. Were these numbers used again on new meters? Could Mr. Scott tell them the approximate life of a diaphragm? and if it was the chief factor in determining the life of a meter? If not, what might be the average life of an ordinary dry meter?

Mr. J. M'GHIE (Glasgow) impressed upon all who contemplated repairing meters not to endeavour to save money on the oil used. In regard to the oiling of the diaphragm from the top, he would be rather chary of saying that it had not proved to be a good thing. They had the experience of one or two large meter makers who stated emphatically that it had been a great success. They had tried it in two different ways. They first placed in the meter a small box, into which the diaphragm dipped and absorbed the oil by capillary attraction. This method was abandoned after a time, because it was found that in the larger sizes the oil only travelled about two-thirds of the way up the diaphragm, leaving the upper part dry. They had been trying, with better success, oiling from the table on the top. Only a few years' experience of this had been obtained as yet; but they were quite pleased with the method. In one or two places where heavy pressures were being used, they had been finding that the pressure was acting on the diaphragms in the extraction of the oil from them. Where there were a number of bye-passes, it was usually found that some of them passed gas without registering. What would be the result, in unaccounted-for gas, with some of the pressures which were now coming into vogue? In the workshop they had been testing one or two rotary meters of the larger size; and they found that unless a rotary meter was passing a minimum of about 70,000 cubic feet an hour it was unreliable. If it were passing this quantity, it was very good. It was a strong point for these meters that they were suitable for use with gas-engines. They did not occupy so much floor space, which was so valuable. It was felt that the earlier defects of rotary meters were being overcome. The idea of leaving detachable cash-boxes of prepayment meters open when they were empty had, it was believed, led to a diminution of the number of damaged meters in unoccupied houses.

Mr. A. H. WHITELAW (Glasgow) thought the members must be struck with the amount of work done in the meter-repairing department of the Glasgow Corporation, when they found that 36,000 meters passed through it in a year. Every one of these meters was put through an initial test, not to find out for what reason they had been brought in, but to ascertain the state of them. They had been told that in the repair of a meter it passed through five tests. The question as to the life of a meter was one that was very often asked. They had meters coming in which had been in continual use for forty years, and which, when tested, were measuring well. He had tested a 20-light dry meter at pressures varying from 0·5 inch to 5 inches. At the former pressure, it passed 120 cubic feet of gas per hour; at 1-inch pressure, 156 cubic feet; at 2 inches, 192 cubic feet; at 3 inches, 228 cubic feet; at 4 inches, 270 cubic feet; and at 5 inches, 312 cubic feet. It would be noticed that all the way up there was a difference of 36 cubic feet per hour. It was found that the meter was 1 per cent. slow under all pressures. The greater the pressure, the quicker the gas passed through the meter. He should like to point out that the greater the pressure at which the gas went through the meter, the more it was in

favour of the consumer. He thought this was a point which was not clearly understood. With a pressure of 5 inches, the gain to the consumer might not be more than 1 per cent.; but supposing it were possible to pass gas through a dry meter at 56 inches pressure, he calculated that the consumer would benefit to the extent of about 14 or 15 per cent. Therefore he should pay more for his gas.

Mr. R. SHEPHERD, jun. (Glasgow), asked Mr. Scott's opinion as to whether back-flame was an entire loss to the supplier of gas. He would also like to know whether Mr. Scott had ever found a meter registering correctly when passing as little as 1 cubic foot per hour; also whether he considered it paid to put safety cash-boxes and patent locks upon meters, so as to prevent money being abstracted.

Mr. W. M. MASON (Glasgow) remarked that in Mr. Scott's paper the members had had laid before them what was practically the experience of a lifetime. Mr. Scott told them that of the meters which passed through their hands in the course of a year, 11,000 were found to be perfectly correct. The question had occurred to him why these meters had been brought in. They were also told that the higher the pressure the slower the meter recorded; but Mr. Whitelaw stated that for each additional inch of pressure the meter recorded 36 cubic feet more gas. On the previous day, a gentleman told him that he had been consuming gas for thirty years, and that when it was charged at 4s. per 1000 cubic feet his accounts were less than they were now. Of course, he (Mr. Mason) told him that he was using far more gas; but he declared that he was not. He said it was the high pressure at which it was being supplied. The public all thought this. It would be an interesting point if Mr. Scott could tell them whether this was the case or not.

Mr. J. WELSH (Glasgow) said his experience was that an architect never considered where a gas-meter should be put. As to the bringing-in of meters, it must be remembered that they were often brought in from houses which had been left empty.

Mr. J. WILSON (Falkirk) mentioned that he knew of cases in which rotary meters, used as discount meters, had been found to be so unreliable that they had been condemned. If they were not working at their full capacity, they did not register anything like correctly. When working at half capacity, the error was very considerable, and, of course, always to the benefit of the consumer. He did not know whether rotary gas-meters were sanctioned by Government.

Mr. A. WRIGHT (Greenock) asked if Mr. Scott found many indices acting adversely, as he came across one the previous day. When sent out, it indicated 1; next time, it was 0·8; then 1·4; then 0·9; and then 1·01.

Mr. W. GRAFTON (Glasgow) pointed out that Mr. Whitelaw had not told the meeting the rates of flow at which his tests were made. A great deal depended upon this, particularly when dealing with the heavier pressures. Taking pressures of from 54 to 60 inches, how were they to ascertain accurately the quantity of gas passed? He found that, taking an ordinary dry meter, proved officially to be correct, it would vary from 3¾ per cent. fast to 14·4 per cent. slow, according to how they used it. This would answer very closely Mr. Mason's remark with regard to the consumer complaining about his gas account. He was unfortunately not working under ordinary conditions. If they were burning 5 cubic feet an hour, they might be 14 per cent. slow; if they were burning full capacity, they might be 3 per cent. fast. He thought this cleared up the matter of the difference of pressure in a meter. The rate of flow must affect the internal resistance in a meter. With regard to heavy pressures, the pressure of the atmosphere was 15 lbs. per square inch. They were accustomed to the use of 40-10ths. This was not an increase of 75 per cent., but of only 1 per cent., because they had to add this pressure over and above that of the atmosphere. An atmosphere, under 40 inches of water, would run into something like 404 or 408 inches, which, *plus* 4 inches, would make 412 inches; so that it really made 1 per cent. Railway carriage lighting was all based upon heavy pressure; and excellent results were obtained from it.

Mr. WHITELAW thought Mr. Grafton had quoted a case which was quite abnormal. They did not expect people who had a 20-light meter to be using only 5 cubic feet per hour. He did not wish it to go abroad that 5000 was the usual number of meters they condemned in a year. Prepayment meters were displacing ordinary meters at an alarming rate; and the latter, for which there was no sale, were being thrown on their hands. One-light meters were being condemned because there was no use for them. Two-light meters were hanging heavily on their hands; and this was the reason why they were converting them into prepayment meters. A gentleman who stood very high in the profession said a few months ago that it would not pay to convert ordinary into prepayment meters. So far as they in Glasgow were concerned, they found it did pay; otherwise they would not be doing it.

The PRESIDENT tendered the best thanks of the Association to Mr. Scott for the very able manner in which he had handled his subject. He considered it was worth their while to go on with the conversion of ordinary into prepayment meters, as it was the conversion of a discredited thing into one of actual use. He thought the tests at from 0·5 inch up to 5 inches were very severe. There were few places in Glasgow where the pressure was up to 4 inches. The day pressure was 40-10ths. But they stood pretty high; and before the gas reached the lower levels he supposed the pressure would be 15-10ths to 20-10ths.

Mr. SCOTT, in replying upon the discussion, said there was no average life of a dry meter, because, as had been remarked, meters were put into all sorts of places, and some of them might only last a year, as they had had in the case of the late exhibition. There 500 meters stood out for a year without any gas passing through them after the exhibition closed; but though the gas was stopped, air got back through the pipes. The meters looked all right outside; but they were entirely gone inside. It was a mistake to allow meters to stand out for any length of time; it paid to bring them in. This was the reason for so many coming in. It was cheaper to bring in old than to purchase new meters. They kept the badges of condemned meters until they had a number of new meters on which to put them. Back-flame was an entire loss to the Corporation. A meter giving back-flame ought to be at once brought in for repair. As to running a dry meter after a wet one, if they had only 0·5 inch pressure he pinned his faith to the wet meter; and they were bound by Government to test meters at this pressure. If they were to use anything higher, they would require to do away with wet meters altogether, because they would not be able to stand the pressure. So long as a rotary meter was working at its capacity, they had fairly good registration by it; but if they took it down to half capacity, he was sure the measurement would be out. In conclusion, he thanked the members for the way in which they had received his paper.

Dow's Brightness Photometer.—At the meeting of the Physical Society at the Imperial College of Science, South Kensington, next Friday evening, Mr. J. S. Dow will show his brightness photometer, which was described and illustrated in the "JOURNAL" for the 18th ult. (p. 199).

Recent Wills.—The late Mr. Arthur Godwin Hammack, whose death was recorded in the "JOURNAL" for the 4th ult., left £6653. Mr. Thomas Whimster, formerly Gas Manager at Perth, whose death, in his 92nd year, was announced in the "JOURNAL" for the 13th of September, left estate of the value of £2665.

The Midland Junior Gas Association will meet next Saturday afternoon, when Mr. W. H. Johns, of Birmingham, will read a paper entitled "Ammonia Recovery, with Special Reference to Apparatus employed therein." The first of a series of "Coffee Meetings" will be held at the conclusion of the business.

Royal Society of Arts.—The opening meeting of the 157th session of the Society will be held to-morrow week, when an address will be delivered by Sir John Cameron Lamb, C.B., C.M.G., Vice-President and Chairman of the Council. From the programme for the session, we find that on the four Mondays before Christmas Mr. C. R. Darling will give a course of Cantor Lectures on "Industrial Pyrometry," and that on the Mondays in March next year, Professor J. A. Fleming, F.R.S., will deliver a similar course on "Applications of Electric Heating." One of the ordinary lectures after Christmas will be by Professor J. Wertheimer, B.Sc., on "Water Finders"—a subject on which, it may be remembered, he carried out some interesting investigations a few years ago.

Proceedings of the North British Association.—We have received the report of proceedings at the forty-ninth annual meeting of the North British Association of Gas Managers, held at Dunfermline on the 28th and 29th of July, under the presidency of Mr. Alexander Waddell, the Engineer and Manager to the Dunfermline Gas Commissioners. The technical matter, which was given in the "JOURNAL" at the time, is followed by lists of the officers and members, the statement of accounts, and the "Statistical Report of the Gas Supply of Scotland" in the year ended May 15, 1910, published by the Committee of the Association. A photograph of the excursion party at Kinross, on the second day of the meeting, forms the frontispiece; and there are portraits of the Presidents and the readers of the two papers submitted (Mr. J. W. Napier, of Alloa, and Mr. James Dickson, of Forfar). The book has been produced under the supervision of Mr. Lawrence Hislop, the Secretary and Treasurer of the Association.

Action on the Eyes of Dust from Tarred Roads.—This subject has lately been dealt with in the "Comptes Rendus" of the Paris Academy of Sciences by MM. True and Fleig. According to an abstract of their communication in the "Journal of the Society of Chemical Industry," it has frequently been observed that the dust from tarred roads has appeared to be more irritating to the eyes than the dust from roads which had not been tarred; and an investigation of this point was made by means of experiments on animals. It was found that dust from untarred roads had only the slightest effect when sprinkled upon the eye, and that dust from old tarred roads from which the coating had more or less disappeared gave effects little different. Dust from old tarred roads with a well-preserved surface brought about conjunctivitis and other lesions; while dust artificially produced from such roads gave still more severe effects. Artificial mixtures of powdered stone and tar gave results corresponding to the proportion of tar contained therein. The authors say this noxious effect of dust from tarred roads is due primarily to the chemical action of the constituents of the tar upon the mucous membrane of the eye; secondarily to the mechanical irritation produced by the dust; and thirdly to the germs present. It was noticed that the dust from tarred roads contained fewer germs than that from untarred ones. The authors consider that these experiments do not constitute an argument against the tarring of roads, which, if well done, they say diminishes the chance of injury to the eyes.

MANCHESTER UNIVERSITY LECTURES ON GAS.

Mr. Dugald Clerk on Explosions in Internal Combustion Engines.

THE second of the series of lectures arranged to be given at the Manchester University on "The Science of Gas Manufacture and Combustion," was delivered on Saturday afternoon by Mr. DUGALD CLERK, F.R.S., M.Inst.C.E., who took for his subject "The Phenomena of Explosions in Gas and other Internal Combustion Engines." Alderman R. Gibson, the Chairman of the Gas Committee of the Manchester Corporation, presided, and was supported by Mr. H. Kendrick, President of the Manchester District Institution of Gas Engineers, Mr. J. G. Newbigging, M.Inst.C.E., the Gas Engineer to the Corporation, Professor Harold B. Dixon, Ph.D., F.R.S., President of the Chemical Society, Mr. F. Thorp, President of the Manchester and District Junior Gas Association, and others. There was a large attendance —upwards of 130 being present.

Alderman GIBSON, in opening the proceedings, said the only certificate which he possessed to justify his taking the chair was that he happened to be Chairman of the Gas Committee of the Manchester Corporation. Those present were, as he understood, more or less experts—they were more or less interested not only in the manufacture of gas but in its scientific and mechanical distribution; and he congratulated them in attending in such large numbers to listen to the lecture which was to be delivered by Mr. Dugald Clerk. This gentleman was, he believed, one of the most competent experts in the country to-day; and there was no doubt that those present would benefit from what he would have to say to them on the subject he had chosen. So far as he (Alderman Gibson) was individually concerned, he was "the least of the apostles;" but he had no doubt they would at the conclusion of the lecture go away wiser and better men, because they could not be wiser without being better. Alderman Gibson concluded by asking Mr. Dugald Clerk to deliver his lecture.

[For the text of the lecture, see pp. 397-400].

Mr. J. G. NEWBIGGING, before formally moving a vote of thanks to Mr. Dugald Clerk for his lecture, said he should like to take the opportunity of congratulating the Manchester and District Junior Gas Association on having enlisted the sympathy and help of Professor Dixon and the University authorities in inaugurating these lectures and the classes which had been formed to enable them the better to deal with the problems they met with in the course of their every-day work. The manufacture and supply of coal gas was entirely different now from what it was twenty or thirty years ago; and though this was a subject which he could not very well go into that afternoon, he might say this—that it became more evident every day that the manufacture and distribution of coal gas must be conducted on thoroughly scientific lines. With regard to Mr. Dugald Clerk, he believed it was nearly thirty years since he read a paper on the gas-engine before the Institution of Civil Engineers; and since then he had lectured on this and kindred subjects, written books and papers continuously, and always been at the service of those interested to give them the benefit of his wide experience and knowledge. In the year 1904, Mr. Dugald Clerk delivered, before the Institution of Civil Engineers—the James Forrest Lecture—which commanded the attention of the man who was in the highest rank of his profession; and he had also written books, one of which he (Mr. Newbigging) very highly prized—that on "The Thermo-Dynamics of the Gas-Engine." This was a work to which he referred whenever he wanted to gain information with regard to the gas-engine. He proposed a hearty vote of thanks to the lecturer.

Mr. JAMES TAYLOR (Mossley), seconding the motion, remarked that the use of internal combustion engines had developed very rapidly during the past ten years; and gas engineers were looking forward to an even greater use of them in the future. They had just received from Mr. Dugald Clerk valuable information on this subject; and with an extension of the use of gas-engines and a greater demand for gas-fires, they would do much in the direction indicated by the Smoke Abatement Society.

Professor DIXON supported the motion. In the first place, he desired to congratulate the Manchester and District Junior Gas Association on having secured so large an attendance to listen to the lecture just delivered. It was a real pleasure to hear a man like Mr. Dugald Clerk, because he brought to bear on the question what one might call unique qualities, and gave his audience the benefit of a mass of experiments. He combined two qualities which were not often found in one man. He was not only able to deal with the scientific side of this difficult question, but with the business side as well. Mr. Dugald Clerk had been a student all his life, and he knew the need there was for a better University training in these subjects, so that students could the better deal with the problems with which they were faced. He (Professor Dixon) thought Mr. Dugald Clerk was a man who had always encouraged students at the University to take up research work, and had impressed upon the authorities the absolute need for extended study and work on these subjects. He was glad to know that the lecturer was not going to sever his connection with the Leeds University, having accepted a seat on the Committee of the Livesey Professorship, the holder of which (Professor Bone) was an old student of Owens College. One felt sure that with a man like Mr. Dugald Clerk upon this Committee everything would be done to urge forward the scientific side, and that no irksome restrictions would be placed upon the holder of that Chair in whatever work he cared to take up.

The resolution having been carried by acclamation,

Mr. DUGALD CLERK, in acknowledging the vote, reminded his audience of the great advances which had been made in the construction of gas-engines since 1876, when the largest then in use in Britain was a 3 H.P. Otto, made by Messrs. Crossley Bros., of Manchester. Now they had gas-engines ranging from ½-H.P. up to 2000 H.P. At a works in the neighbourhood of Manchester—those of the "National" Gas-Engine Company, in which he was interested—he had seen started that day a gas-engine of 750-H.P., which was the largest engine sent out from the works. He admitted that he was still fond of experimenting in the laboratory, and had in recent years paid a little more attention to the business side of his profession. In his early days, as an inventor and an experimentalist, he shared the usual fate of the pioneer—getting "plenty of reputation but few ha'pence."

Mr. H. KENDRICK (Stretford), in proposing a vote of thanks to Alderman Gibson for presiding, said that gentleman was the leading administrator of the largest gas undertaking in the North of England, and his reputation would bear investigation from every point of view. Alderman Gibson's conduct of the affairs of the Gas Department of the Manchester Corporation was watched with interest by everyone connected with the gas industry; and though, in his modesty, he had described himself as "the least of the apostles," this was not the title they, as gas engineers, would give to him—in fact, they would be inclined to say in Manchester that he was the leader of the apostles, and those present were exceedingly pleased to see him in the chair.

Mr. S. MEUNIER (Stockport), seconding the motion, remarked that Alderman Gibson had always taken a deep interest in the welfare of the department of which he was Chairman, and had also shown that he had the interests of the ratepayers as a whole at heart. They all remembered the fight he waged in the City Council with regard to what would be the best business policy to be adopted by the Gas Department—whether they should make huge profits to hand over in relief of rates, or whether it would not be better to reduce the price of gas, and make it more popular, particularly for heating and cooking, and thereby make the town cleaner and healthier. Alderman Gibson was opposed to the gas departments of corporations being called upon to hand over large sums in aid of the rates; and in his endeavour to bring down the price of gas to the smallest possible figure, he was assured of every assistance from Mr. Newbigging, the Engineer to the Gas Department.

The motion was carried with much applause.

Alderman GIBSON, in responding, said that gas engineers could help him much in the carrying out of his policy with regard to gas undertakings. He thought it was a monstrous thing, a gross injustice, unfair, and dishonest, to take money out of the pockets of the poor gas consumers, and put it into those of the rich and the large ratepayers who did not consume gas at all. Why this was done passed his comprehension. When he heard people complaining as to the quality of gas—he supposed they would always have these complaints—he often thought how much better it would be if they tried to educate the people to understand that it was the poor gas consumer who ought to be considered, especially the smaller shopkeeper who had to light his gas early in the afternoon and keep it going until late at night in order to eke out a living. He was satisfied that a cheapening of gas would be to the benefit of the community; and he would not rest satisfied until he had gas-fires in every office in Manchester and so improved the atmosphere in the city.

Cowpe (Bacup) Water-Works Award.—At the Bacup Town Council meeting on Friday week, Alderman J. Craven-Hoyle, the Chairman of the Finance Committee, said, with reference to their final arbitration on the subject of the Cowpe Water-Works, that the amount in dispute between the Corporation and the Contractor was £10,200, and the sum disallowed by the Arbitrator was £8054. The total amount the Corporation would have to pay when they met the award was £122,096. With regard to the original contract, it was rather hard to say how it compared; but there was extra work costing £1666. Then there had been a serious unforeseen fault in the strata, which swallowed up some thousands of pounds, and made the expenditure on the works much heavier than the Corporation thought it would have been. There would be no costs paid to Mr. Diggle for the arbitration, except out-of-pocket expenses, of which the Corporation's share was £36—each side having to pay half.

Hereford Water Supply.—On behalf of the Local Government Board, Mr. A. A. G. Malet has held a public inquiry into an application by the Hereford Town Council for sanction to borrow £7000 for the construction of new filter-beds at the water-works. Mr. Holt, the Town Clerk, stated that the rateable value of the city was £131,817, the assessable value £127,770, and the total outstanding debts £158,207. The rates were 5s. 7d. in the pound. The capital expenditure on the works was £50,760, of which sum only £10,350 was now owing. It was proposed that two additional filter-beds should be provided, with an area of 20,000 square feet each, thus trebling the present filtering-area, and giving a capacity of 1,128,000 gallons in sixteen hours, during the time any one bed was being cleaned. Under the present system, the city was deprived of 50 per cent. filtering capacity during cleaning operations. It was pointed out that the Council would be able to carry out the scheme without imposing any burden on the ratepayers, as there was ample surplus revenue to pay the whole of the cost.

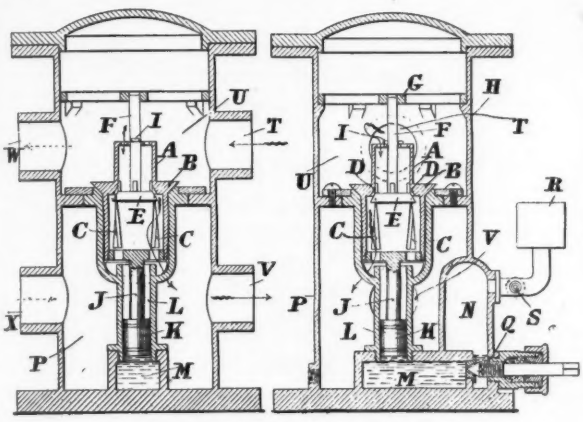
REGISTER OF PATENTS.

Gas-Compressors.

BROWN, T. W., of Newington Butts, S.E., and TILLEY, F. C., of Kingsland Road, N.E.

No. 22,308; Sept. 30, 1909.

This invention relates to compressors in which a pump or blower draws in gas and passes it to the burners in a state of pressure; a valve connecting the inlet and outlet so that, should the pressure become excessive, it will open the valve and relieve the pressure at the burners—some of the high-pressure gas passing back again to the blower and continuing to do so until the pressure on the outlet side is reduced and the valve thereby closed. The invention essentially consists in the particular way in which the bye-pass valve is arranged inside the relief valve.



Brown and Tilley's Gas Compressors.

The illustration shows sections (at right angles to each other) of the gas-compressing plant.

The relief valve A (of cylindrical form) is provided with a bead or ring B at some part of its length, below which is formed in the wall of the valve holes or slots C (graduated or not). Within the valve and above the holes is a seating D for a valve E, which is so positioned that it has a tendency to drop away from the seating, but is held to the relief valve, so as to prevent it entirely falling away from it, by a rod F passing through a bar G fitted inside the casing H and provided with a pin I, which lies on the valve A when the valve E is open.

The relief valve A (controlled by weights or springs) is provided at its base with a rod J, piston K, or cup leather positioned in a cylinder L, the bottom of which is provided with a chamber M connected with another chamber N outside the chamber P by a regulating valve Q—the chamber N being in connection with a supply-tank R provided with a shut-off valve S.

At ordinary pressure from the mains the relief valve A is on its seating, and the valve E inside the relief valve A is open. Gas then flows through it from the main T into the chamber U and past the valves A and E to the burners by the exit V of the chamber P, as shown by the arrows in full line. On starting the pump or blower (connected with the chamber openings W X), the gas in the chamber U is drawn through the exit W and forced into the entrance X of the chamber P (as the dotted arrows), and a pressure is created in the chamber P. This pressure acts upon, and closes, the valve E inside the relief valve A, stopping the flow of gas through these valves; and when the pressure becomes excessive, the relief valve A is lifted from its seating and some of the gas under excess of pressure passes through the slots C in the wall of the valve and passes to the inflowing gas in the chamber U, to be again acted upon by the pump or blower.

During this rise of the relief valve, the piston K (or the cup leather on it) has been lifted in the cylinder L and sucked air or other fluid or liquid through the pipe M from the chamber N into the cylinder L. But by reason of the regulating screw Q on the pipe only allowing a small quantity of liquid to pass, a drag has been put upon the valve A and piston K; and so the valve A is kept steady. When the pressure of gas at the burners has been sufficiently relieved, the valve A drops and steadily closes more or less, as the liquid in the bottom of the cylinder can only flow back into the vessel in a gradual manner, because of the regulation of the orifice of the pipe by the screw. When the pump or blower stops, the valve E, inside the relief valve A, will drop; and the gas then passes to the burners under normal pressure.

Revivifying Sulphuretted Oxide from Gas-Works.

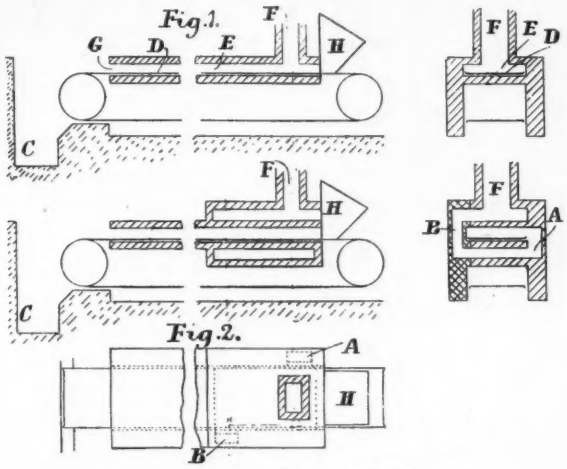
WYLD, W., of Leeds, and GREEN, H. E., of Yardley.

No. 22,514; Oct. 4, 1909.

This is a method to just sufficiently heat the oxide to cause ignition of the sulphur and to bring it into contact with a cooler atmosphere directly the sulphur has been consumed, as the patentees say they find then that the residual iron compound is capable of absorbing sulphuretted hydrogen and may be used for this purpose in the purification of coal gas and for other like purposes.

Fig. 1 is a section and end elevation of the most simple type of furnace for carrying out the invention. Fig. 2 is a modified form of furnace.

The inventors preferably use a travelling band or series of trays D (fig. 1) passing through a heated flue or chamber E, connected in the ordinary way with a Glover tower or its equivalent by the flue or stack F. On this band the spent oxide is evenly distributed (from a hopper H) to a suitable depth by mechanical means; the speed of the band being regulated so as to concentrate as much of the heat as possible to one small zone of the furnace—near the flue F—air being induced in the opposite direction to that of the movement of the band so as to facilitate the control of the heat. The oxide passes forward and discharges from the band into the chamber C, separated from the main flue E by any desirable means.



Wyld and Green's Oxide Revivifier.

To more easily confine the heat to one constant zone of the furnace, the flue E, before entering F, is conducted for a suitable distance under and/or over the band D by side flues A B (figs. 3, 4, and 5).

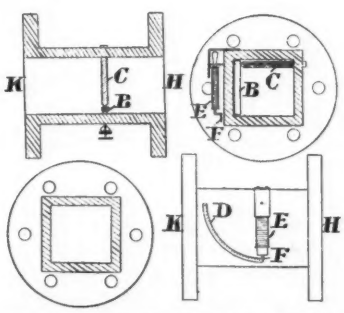
By this method there is obtained a residual iron compound leaving the furnace at G, "which is capable of absorbing sulphuretted hydrogen, and is suitable for the before-mentioned purposes."

Gas-Meter.

TIDDEMAN, P. J. S., of Stoke-on-Trent.

No. 23,376; Oct. 13, 1909.

This invention relates to an improved device for indicating the amount of gas or steam flowing along a pipe (say) from H to K in the illustration.



Tiddeman's Indicator of Gas Passing Through Mains.

As shown, the body of the meter consists of a piece of pipe, made of some non-magnetic metal, for insertion into the pipe-line. In it is a hanging gate B, hung from a bearing comprising the point of a screw C and a projection on the side of the pipe. This gate is not necessarily of the same size as the section of the inside of the pipe, and is shown as a strip of soft iron. In any case, the gate will contain a piece of soft iron so that it is magnetically inductive. The gas or steam flowing along the pipe causes the gate to swing over a quadrant corresponding to the scale D; and the position will be proportional to the amount passing. On the outside of the pipe is a balanced swinging electro-magnet E, hung in such a way that it and the iron of the gate move in parallel lines; and in consequence of the magnetic attraction between the electro-magnet and the iron on the gate, the electro magnet always sets itself to indicate the position of the gate. The pointer F indicates how much gas is passing; but the electro-magnet can also be caused to work a pen, which, drawing a line on a revolving drum, will give a permanent record of the amount passing.

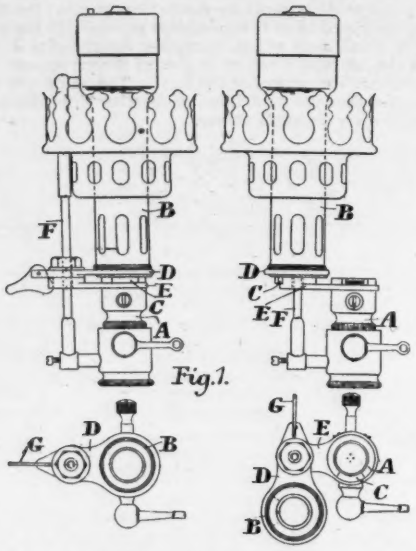
Incandescent Gas-Burners.

COCKE, J. J., of Peckham, S.E.

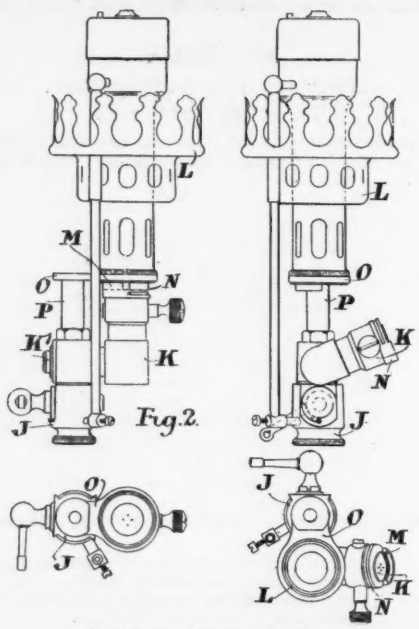
No. 23,633; Oct. 15, 1909.

This invention relates to incandescent gas-burners constructed in such a way that the gas-nozzle, the mixing-tube, and the parts usually carried thereby, may be moved out of line, so that the nozzle and interior of the burner-tube are accessible for inspection and cleaning. This may be effected either by turning the burner-tube on a vertical axis into a position parallel with the vertical axis of the nozzle, or by

rocking the nozzle on a horizontal axis from a vertical position into a position inclined with regard to the burner-tube, which remains vertical.



In fig. 1, A is the stationary part of the fitting containing the gas-nozzle, and B is the movable part comprising the bunsen tube. D and E are a pair of plates—the former fixed to the part B, the latter to the part A. These plates have threaded through their ends the bye-pass tube F, which receives lateral support from the plate E and forms a pivot pin for the plate D and the parts supported thereby. The tube F is completed by a sleeve carried by the upper part of the burner and capable of turning on the tube. It will thus be seen that the plates and the burner carried thereby can be swung round as shown. C is a stop which enables the parts to be properly centred, and G is a catch to hold the parts when in working position.



Cooke's Incandescent Gas-Burners.

In fig. 2, the upper part L of the burner is supported by a bracket O carried by a standard P fitted to the gas-supply fitting J. K is a movable part containing the gas-nozzle. It is fitted to rock on a centre projecting from the standard P, which is hollow and forms a pipe for the passage of the gas to the nozzle. M is a stop on the part O; and N is a ring on the part K for securing the parts together when in position. It will be seen that the part K can be tipped out of line with the rest of the burner, so as to expose the nozzle as in the other arrangement. Access is thus provided to the nozzle and the interior of the burner without dismounting the mantle or removing the chimney.

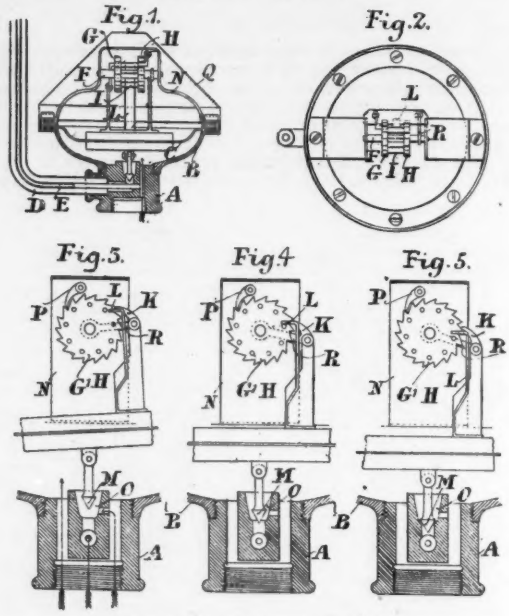
Operating Gas-Valves from a Distance.

SCHNORRENBERG, L., of Cologne.

No. 26,217; Nov. 12, 1909.

This gas-igniter, operated from a distance by pressure impulses, is provided with a diaphragm, which carries, on the one hand, a conical valve disc and, on the other hand, is provided with ratchet mechanism which, when the pressure wave diminishes, holds the diaphragm with the valve disc in the open position. Gas-igniters of this type are more or less alike, says the patentee—the principal difference between them consisting almost solely in the form of the ratchet mechanism of the valve. "All suffer from the drawback, however, that the arrangement of the individual parts is too complicated, and the friction between the same is so great that, in general, they cannot be used satisfactorily in practice."

Fig. 1 is a vertical section through the gas-igniter arranged according to the present invention. Fig. 2, a top plan view, partly in section. Figs. 3, 4, and 5 show the ratchet mechanism and the valves on an enlarged scale in various positions.



Schnorrenberg's Gas-Lamp Igniter.

A is the socket through which gas flows into the casing B, under the diaphragm C, into the burner pipe D, and through the small tube E to the igniting flame. F is an angle journaled in the holder N, on which axle ratchet-wheels G H are mounted. Both wheels have an equal and even number of teeth; and for the arrangement of evening and night lamps must be also divisible by three. The wheels are connected with one another by rods, the number of which is equal to half the number of teeth of one wheel. The pawl K is pivotally attached to a member carried by the diaphragm C, and rises with the diaphragm when a pressure impulse occurs in the piping—thus feeding the ratchet-wheel G one tooth. In order that the pivots of the ratchet-wheel and detent always remain at the same distance from one another when the diaphragm rises and falls, the pivot of the pawl is revolubly connected with the axle F by an arm or link R. L is a hook or catch (likewise mounted on the diaphragm) arranged between the wheels G H, and adapted to rise freely simultaneously with the pawl K when a pressure impulse occurs in the piping. The operative part of the hook is arranged transversely of the rods or pins I; and after the impulse has ceased, the hook is either suspended on one of the small rods I under it—thereby preventing the diaphragm falling, and securing that the valve M located under it is kept open—or, in the event of the small rod being lacking, the diaphragm falls further, whereby the valve M closes. As the diaphragm is placed slantwise during a pressure impulse, the valve M is suspended to swing from the diaphragm, and projects, in addition, into a funnel-shaped casing or box O, so that it is guided with certainty on to its seat in the casing. P is a detent engaging in the ratchet-wheel G and preventing the pawl and ratchet mechanism moving backwards when the pressure impulse ceases. Q is a hood for protecting the ratchet mechanism.

If the pawl K has arrived at its highest position (owing to an impulse in the piping), and the ratchet mechanism is consequently in the position shown in fig. 3, after the impulse has ceased the diaphragm C, with the pawl, hook L, and the valve M, suspended freely under the latter, will fall back, but only so far until the hook remains suspended on the first rod I located under it. The dimensions of the individual parts are so selected that in this position the valve M remains open, as in fig. 4; and the lamps can burn. When another pressure impulse occurs in the piping, the ratchet mechanism will be fed forward one tooth by the pawl K. On the impulse ceasing, and the diaphragm E, together with the pawl K and hook L, falling back (since a rod I is lacking, on which the hook could be caught), the diaphragm will descend further, and the valve M, suspended freely under the latter, will return to its seat, as in fig. 5. When the subsequent impulse occurs, the valve will be opened again, as described, and so on; so that whenever an impulse occurs the valve is alternately opened and closed.

Incandescent Gas-Light.

SÜSSMANN, H., of Berlin.

No. 29,650; Dec. 17, 1909.

This is a "patent of addition" to patent No. 27,869 of 1909, in which an upright burner for incandescent light has between the burner-tube and the nozzle-tube an insulating sleeve, while the chimney gallery is in direct metallic connection with the inset-tube carrying the burner-head. According to the present invention, the metallic connection of the chimney gallery with the inset-tube is avoided by arranging a bad conductor of heat between the inset-tube and the chimney gallery, or by fitting the latter on the nozzle-pipe. By the new arrangement, the effect of the burner is said to be improved

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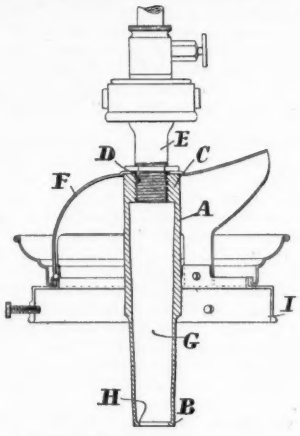
"inasmuch as the heat which is conducted downwards through the burner-tube from the flame is prevented from passing to the chimney gallery, and thus being lost by radiation." Trials are said to have shown that with the new arrangement the gallery remains cold, "which is a sign that the heat cannot be lost by radiation. Therefore, the quantity of heat which is transferred to the chimney gallery by radiation from the flame and conduction from the chimney is entirely used up for the preliminary warming of the secondary air."

Inverted Incandescent Gas-Lamps.

BLAND, C. W., of Little Trinity Lane, E.C.

No. 5151; March 1, 1910.

This invention relates to an uncurved mixing tube and burner for an inverted incandescent gas-lamp constructed of one piece of some material that "will not scale or otherwise become deteriorated due to the great heat to which burners and their mixing-chambers are subjected or to moistures of atmosphere after cooling, whereby the mantle is not injured by falling particles of the mixing-tube."



Bland's Inverted Gas-Burner.

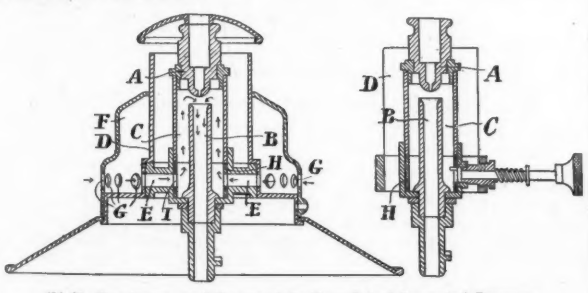
As shown, the mixing-chamber A and the burner B are made of steatite, fire-clay, or other fire-proof earthy material; the upper portion C being provided with a screw-thread D for attachment to the mixing-chamber E, which is here situate above and outside the heat-shield or dome F. The inside part G of the mixing-tube is tapered, with its narrow end next the burner B, which is provided with an internal flange H; while the outside portion is made of two diameters—the end of the larger part carrying the screw-thread D, the other or smaller end forming the burner. The patentee prefers that the mantle be supported from a separate ring or frame (not shown) held to the lamp-ring I.

Inverted Incandescent Gas-Lamps.

WOLF, O., BAMBURY, N. F., and BERNARDY, E., of Bradford.

No. 526; Jan 8, 1910.

The object of this invention is to provide an arrangement whereby the air, before it reaches the mixing-tube of the burner, is heated to such a degree as to ensure its specific weight being as near as possible that of the inflowing gas. This object is attained by making provision for subjecting the air to a preliminary process of superheating on its way to the air inlets and superheating chamber by means of an enclosed chamber arranged around the lower part of the chimney and in close proximity to the burner.



Wolf, Bambury, and Bernardy's Regulated Inverted Burner.

A is the gas-nipple, B the mixing-tube, C the superheating chamber, and D the chimney. The superheating chamber (carried by the nipple) is provided at its lower end with an annular bracket, whereby the chimney and shade are supported.

The air passes through passages E, arranged radially across the lower part of the chimney, into the superheating chamber C; while the products of combustion from the burner, as they rise through the chimney, play round the air-passages and superheating chamber, so as to superheat the air on its way to the mixing-tube B, where it meets the gas entering through the nipple. The mixture then passes down the mixing-tube to the burner mouth as shown by the arrows.

By arranging the air-passages in close proximity to the burner mouth, they are subjected to the fullest amount of heat rising from the latter; the air passing into the superheating chamber being distributed evenly all round the mixing-tube, and thus obviating the bad effects of one-sided currents noticeable in bunsens where the air inlets are arranged about on a level with the end of the gas-nipple.

Provision is made in the lamp of means which will ensure the air being heated to such a degree that its specific weight will be as near as possible the same as that of the inflowing gas. These means consist of an enclosed chamber F arranged exteriorly around the lower part of the chimney, and in close proximity to the burner mouth. The entrance of air into this enclosed chamber is provided for by means of a series of perforations G, and the air passes out of the chamber through the passages E. The enclosed chamber is heated from the lower portion of the lamp by the heat which rises from the globe, and also from the chimney; and as the air passes through this chamber, it receives a preliminary heating, so that it does not enter the passages E in a cold state—thus greatly assisting a better burning of the mixture of gas and air.

The means employed for regulating the admission of air to the superheating chamber comprises a cylindrical slide H arranged below, and as a continuation of, the chamber C. The slide is perforated at I and actuated by means of a spindle carrying an eccentric pin at its inner end, which engages a vertical slot in the slide, so that as the spindle is rotated an oscillatory movement is imparted to the slide, which, in moving over the inner ends of the air passages E, opens and closes communication between the passages and the superheating chamber C.

Indicating the Escape of Gas from Pipes or Conduits.

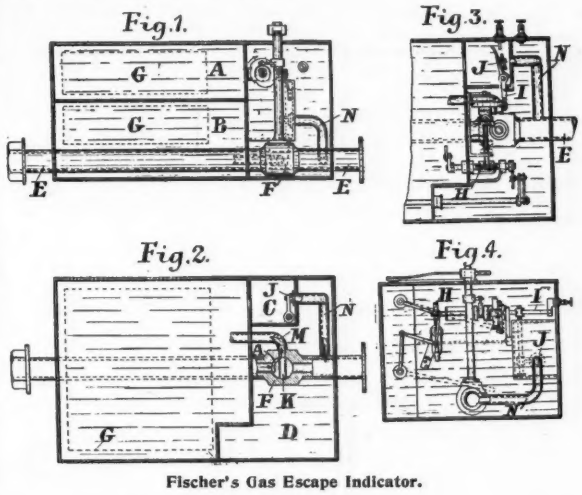
FISCHER, P. G., of Stuttgart, Germany.

No. 12,515; May 23, 1910.

This apparatus "renders unnecessary the closing of the main cock of a gas-pipe or conduit, and yet prevents any escape of gas which would be dangerous to life."

This result is attained in two ways by one and the same means—viz., a rotary lever or a rack acted upon by a disc or a wheel rotated by gas-meter mechanism or some gas-current motion-device in such a manner that in the first place an audible or a visual signal is given and, after the passage of a predetermined quantity of gas through the pipe containing the motion-device, a valve is closed in the pipe, which previously permitted an uninterrupted flow of the gas.

During the regular consumption of the gas, the apparatus is switched-out. For this reason, it is arranged in a bye-pass to the main gas-pipe—a bye-pass closed during the regular consumption of gas, when the gas flows directly through the main pipe. After the normal or regular consumption has ended, the main pipe is closed or the flow of gas interrupted, but is completed again through the bye-pass, into which the safety and signalling apparatus is built, in such a manner that gas can flow in the pipe, until the bye-pass has also been interrupted by the apparatus by the closing of a valve.



Fischer's Gas Escape Indicator.

Figs. 1 and 2 are a side elevation and plan of the parts whereby the apparatus is connected to the gas-pipe. Fig. 3 is a plan of the parts whereby the signalling and automatic closure of the pipe are effected. Fig. 4 is an end elevation of fig. 3.

The apparatus is enclosed in a casing divided into a number of chambers, of which two, A and B, contain a "motion-device" driven by the current of gas. A chamber C serves as a gas-collector; and in the fourth, D, is mounted the mechanism for operating the signal and for closing the shut-off valve.

To the casing is connected a pipe E, which is preferably built-into it; and in it is inserted a valve or cock F, whereby, according to its position, the gas is either conducted directly through the pipe E or through the motion-device G. This device may consist, for example, of that used in gas-meters, and comprising two bellowslike bodies which are alternately traversed by the gas, so that the current flows uninterruptedly through the bye-pass. The motion produced by the alternate inflation and collapse of the diaphragms controlled by two slide-valves (not shown) is transmitted by levers to the actuating gear, and is converted into rotary motion by two levers and links and an adjustable crank. On the crank-shaft is mounted a worm, which engages in a worm-wheel H. On to the shaft of the worm-wheel is slid a cam-disc, which is free to turn relatively to the shaft, but cannot be moved axially. This cam-disc is acted on by a spring fixed in such a manner that it is tensioned in the turning of the disc as soon as the latter is coupled to the shaft, and after disengagement of the coupling, the disc turns back to its original position. The disc acts on a lever I which makes electrical connection with the terminal and, after the lapse of

some time, closes the shut-off valve J. In order to effect these two operations, the cam-disc has two notches of different depths, into which falls a pin that can be provided with a roller and is fixed to the lever I, which is made in the form of a double lever.

The turning of the cock F, with passages K L, takes place by means of a rod provided with an external handle or pointer, and with a slotted arm, to which is connected a fork for throwing the movable coupling-sleeve into and out of engagement.

The bye-pass through the pressure-gas motion device is formed by the pipe M, which is connected to the cock-casing F and terminates in the slide-valve-casing of the motion-device (fig. 2) and by the pipe N, which opens into the main pipe above the cock and is connected at the other side to the gas-collecting chamber C. The opening of this pipe into the collecting chamber is closed by the valve J, which is mounted on one shaft with the contact-lever I. In this manner the pressure of the gas acts to keep the valve tight when closed, and effects a complete closure of the pipe.

The method of operation is as follows: As soon as the normal consumption of gas is ended (the main cock being open), the cock F is turned, and by this means the apparatus is switched into the gas-passage. If there is no flow of gas, the apparatus remains at rest. If, however, a flow takes place—for example, through a fault in the piping or a cock being left open—the motion-device G comes into operation and turns the worm fixed on the shaft, and rotates the disc, since, by turning the cock F, the coupling has been simultaneously moved into engagement by means of the arm and actuating fork.

So long as the valve J is open, gas flows out of E through L, pipe M, motion-device G, collecting chamber C, valve J, and pipe N, back to the pipe E. When, however, the pin falls into the first notch, the shaft of the double lever I turns, and its contact spring touches the terminal, and closes the circuit of the signal. Being thus brought to notice, the damage can be repaired; otherwise the device turns further until the pin falls into the second deeper notch of the disc, and by this means the valve J is pressed on to its seat, against which it is held fluid-tight by the gas-pressure. The passage is thus shut off and the flow of gas interrupted.

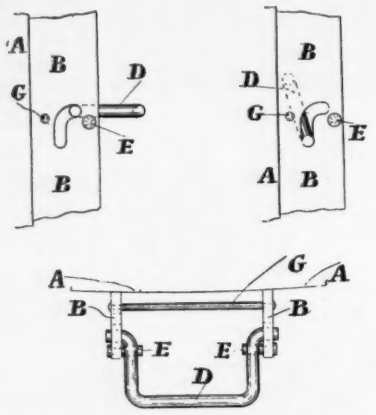
If the device is to be brought back into its original position, the cock F is turned by turning the rod so that the passage K makes direct connection in the pipe E. At the same time the coupling is thrown out of engagement by the arm; and the disc, under the action of the spring, is turned back into its original position relatively to the lever I. The cycle of operations can begin again after the rod has been turned and the device again switched in.

Ladders for Spiral-Guided Gasholders.

DAVEY, A. E., of Aberdare.

No. 3177; Feb. 7, 1910.

This invention relates to ladders, more especially for use with spiral-guided gasholders where the spaces between the telescopic lifts are limited, and the ladders have ordinarily to be fixed in close proximity to the surface of the shells.



Davey's Ladder for Spiral-Guided Gasholders.

Side elevations and a plan are given of a ladder, showing one step arranged according to the invention. A is a portion of the gasholder, and B is part of the side of a ladder attached to the shell, and which sides do not project sufficiently to foul the lower lift at any position (when one exists). The side B is shown provided with a curved slot, engaging with which is the end of the rung D. In the first position, the rung is shown in the extended position ("in order to afford ample and safe foothold") resting upon a pin or projection E. In the second sketch, the rung is shown tilted back (not in use), and a stop G may be provided for it in the position given. A fixed handrail—flush with the side of the ladder, or only projecting very little—may be employed if desired; but the ladder sides themselves may be used as handrails by being of beaded or like suitable formation.

New Joint-Stock Companies.—There were registered in Edinburgh last week the St. Andrew's Gas Company, with a capital of £16,960, in £10 shares; and the Tillicoultry Gas Company (a private concern), with a capital of £6900, in £5 shares.

The Lighting of Calcutta.—Mansfield's improved inverted incandescent gas-burner (which was described and illustrated in the "JOURNAL" for the 18th ult., p. 195) has, we learn, been considered by the Corporation of Calcutta; and Messrs. Mansfield and Sons, Limited, have received an order for 9000 as a first instalment towards the lighting of the city.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Special Courses of Lectures at Leeds University.

SIR,—May I venture, through your columns, to draw attention to the future arrangements for special lectures on the manufacture, distribution, and uses of coal gas, and on bye-product coking processes, in connection with the work of the Department of Fuel and Gas Engineering in the University of Leeds.

During the two past years, as your readers are doubtless well aware, courses have been given on (1) "The Manufacture of Coal Gas," by Dr. Harold G. Colman, and (2) "Bye-Product Coking Processes," by Mr. Ernest Bury, M.Sc. Both courses were attended by some thirty students drawn from a very considerable area of the North of England. Under the new arrangements now contemplated, the scope of these special courses will be considerably extended, and will now include a two years' systematic course in the manufacture, distribution, and uses of coal gas. The course of twenty lectures on the "Manufacture of Coal Gas," which was given by Dr. Colman during the first term (January to March) of this year, will be repeated in 1912, 1914, &c.; and, alternating with Dr. Colman's course (viz., in the years 1911, 1913, &c.), there will be a new course on "The Distribution and Uses of Coal Gas."

From the preliminary announcement which appears in your advertisement columns, it will be seen that the new course of twenty-two lectures, to be given on Wednesdays at 6 p.m. and on Thursdays at 9 a.m. during eleven consecutive weeks commencing Jan. 11 and ending March 24, 1911, will include four sections—viz. (1) Eight lectures, on the "Distribution of Coal Gas," by Mr. Walter Hole, of Leeds; (2) four lectures, on "Gaseous Combustion and the Structure of Flames," by Professor Smithells and myself; (3) six lectures, on "The Uses of Coal Gas for Heating Purposes," by Mr. John Bond, of Southport; and (4) four lectures, on "Gas Lighting and Photometry," by Mr. Jacques Abady, of London. It is hoped the important subjects comprised in this course, as well as the distinguished outside lecturers who have so kindly consented to help the University in this movement, will attract a large audience from among the young gas engineers in the North of England.

In addition to the above lectures, Mr. Bury will again give his course of eight lectures, on "Bye-Product Coking Processes," on Saturdays at 3.30 p.m., commencing Jan. 21, 1911. Mr. Bury's name is already well known to your readers as an acknowledged authority in all matters relating to coke-oven practice; and his recent association with the scheme for supplying Little Hulton with coke-oven gas for lighting purposes (which was largely due to his foresight and initiative) is a sufficient guarantee that he will treat this important branch of carbonization in a way which cannot fail to interest and stimulate gas engineers. He will in particular deal with the latest developments in regard to direct ammonia recovery methods. So far as future years are concerned, Mr. Bury's course will be repeated in 1913 and 1915, &c.; and, alternately with this, we hope to arrange, for 1912, 1914, &c., a special Saturday afternoon course on "Refractory Materials."

The ultimate success of the above arrangements, and the ability of the University to extend or supplement them by other courses, will very largely depend on the response which will be forthcoming from the industries concerned during the next year or two. The special outside lecturers whose services have been secured in connection with this scheme will be put to considerable personal inconvenience and sacrifice of time in order to fulfil their engagements; and I therefore earnestly appeal to young gas engineers throughout the North of England to make the fullest use of the opportunities which are now open to them. May I also venture to extend this appeal to those responsible for the management of gas undertakings, that they will support the efforts of the University by liberating such of the junior members of their staffs as may desire to attend these courses.

WILLIAM A. BONE,
Livesey Professor and Head of the Department of Fuel and Gas Engineering.

Leeds University, Nov. 5, 1910.

The Midland Association Carbonization Discussion.

SIR,—I notice that a leading article in the current issue of the "JOURNAL" contains the following: "And the fact that at Guildford it has not been adopted in the new retort-house, has not been in its favour."

It is only fair to state that the fact that we have put horizontal retorts in our new retort-house here bears no more significance with reference to Mr. Love's principle than the adoption of horizontal retorts would in any other works of a similar size. When I came to Guildford, there was only one setting of Love's 45's, and that an experimental one in a bad state of repair. It was not even in use, and was never lighted up afterwards. I had, therefore, had no experience of them; so the mere fact that I recommended horizontals should not carry any special weight.

I was rather afraid that the adoption of horizontals at Guildford might adversely affect the consideration of Love's 45's elsewhere; and I am glad to take advantage of this opportunity of stating the facts.

P. C. CLEASBY.

Guildford, Nov. 2, 1910.

[It is a pleasure to have Mr. Cleasby's letter, and to give it publicity. The first two lines of his last paragraph: "I was rather afraid that the adoption of horizontals at Guildford might adversely affect the consideration of Love's 45's elsewhere," precisely explains what was in mind when, last week, in the comment on the carbonizing discussion at the Midland Association meeting, we wrote: "The fact that at Guildford it [the system] has not been adopted in the new retort-house, has

not been in its favour." Had we expressed ourselves in the converse form: "If the system had been adopted in the new retort-house at Guildford, it would have been greatly in its favour," the meaning intended to be conveyed by our words would have been the same. It is quite natural that, when a new engineer of a works is appointed, and new plant is required, he should follow lines upon which he has, through personal experience, every reliance; and this, of course, is fully recognized, and not necessarily to the detriment of systems that he has not adopted. Considering our remark from all points of view, we cannot admit that the statement is in any way misleading. We believe that there are other settings of Love's 45's at work; and, it is understood, doing well. It will be interesting to have the working particulars as soon as publication is permissible.—ED. J.G.L.]

Mantle Renewals in High-Pressure Inverted Lamps.

SIR,—As many of your readers have probably seen the article, on "High-Pressure Maintenance," recently published in the "Electrical Times," in which the writer endeavours to prove that the cost of mantle renewals makes this method of street lighting prohibitive from a commercial point of view, I think our experience in this matter at the "White City" may be both interesting and instructive.

In the Japan-British Exhibition which has just closed, we had 355 Keith 1500-candle power lamps. Of these, 309 were in the grounds, and therefore exposed to the weather in just the same way as ordinary street-lamps. The number of new mantles required for these 309 outside lamps during the six-months' run of the Exhibition was:

In 39 of the lamps	None.
,, 92 ,, ,,	1
,, 85 ,, ,,	2
,, 80 ,, ,,	3
,, 13 ,, ,,	An average of 6.

There were altogether 580 mantles used, or an average of 1·87 per lamp; and I may say that no mantle was allowed to remain on after it showed the least sign of deterioration.

The average would have been lower if all the lamps were of the latest pattern; but some of them are three years old.

Speaking generally, the record at the Exhibition confirms our experience of the low cost of mantle renewals necessary for high-pressure lamps, and certainly goes far to defeat the attempt made in the Electrical Press to depreciate their value in this respect.

E. R. H. WINGFIELD, Chief Inspector.

Brentford Gas Company, Nov. 2, 1910.

Vertical-Retort Working.

SIR,—In the discussion on the President's Address at the recent meeting of the Manchester District Institution of Gas Engineers, the President (Mr. H. Kendrick) and Mr. T. Duxbury are both reported to have expressed doubt as to the economical advantages of vertical retorts. Also, at the recent meeting of the Midland Association of Gas Managers, Dr. Davidson is reported to have said that he "believed it was pretty well admitted now that vertical retorts were not very strong on the illuminating power basis;" and Mr. Harrison asked the question whether it was possible to instal vertical retorts economically on a works making under 100 million cubic feet per annum.

Will you allow me to say in reply that, even assuming the cost of working horizontals by machinery to be rather less than 7d. per ton of coal carbonized, when the plant is in full operation, it can be shown that, with the latest Dessau settings, a saving is effected equal to fully 15 per cent. per annum upon the extra capital cost, in working expenses alone. There are also to be placed to the credit of the system the further very substantial saving by the increased yield of gas, tar, and ammonia, greatly improved quality both of tar and coke, and freedom not only from naphthalene, but also from excess of sulphur compounds—to say nothing of the absolute simplicity in working, and entire independence of machinery.

On the question of cost of wear and tear, Herr Prenger, the Engineer of the Cologne Gas-Works, finds, after four years' experience, that the cost for repairs of Dessau verticals is less than one-third that of horizontals. Quite recently he, for the first time, repaired the lower parts of some of his settings, which had been in operation for over a thousand days; and he estimates that these will now last for a further eleven to twelve hundred days before renewal of the upper parts becomes necessary. The experience of other engineers confirms that of Herr Prenger, and leaves no room for doubt as to the great superiority in this respect of Dessau verticals. It may be further pointed out that the discussion between Mr. Harris (the author of the paper) and Dr. Geipert, published in the "JOURNAL" early in the year, conclusively proves that no apprehension need be felt as to the behaviour of Dessau verticals when worked intermittently, inasmuch as settings have been repeatedly let down and relighted without the slightest injury to the brickwork or the retorts.

With regard to the alleged reduction of illuminating power, Dr. Davidson may be referred to the comparative table which forms part of Mr. Harris's paper, and which was reproduced in the "JOURNAL" for March 8, 1910, p. 662. It will be seen from this that the Sunderland tests, so far from showing any falling off in illuminating power, actually head the list for quality of gas, although the coal used for these tests was unscreened ordinary Durham.

May I, in conclusion, inform Mr. Harrison that the Dessau system of vertical retorts is adaptable to a works of the size he names—viz., 100 million cubic feet per annum.

17, *Victoria Street, S.W., Nov.* 5, 1910. C. HOLMES HUNT.

The Finance Committee of the Leeds Corporation have passed a resolution approving of a quarterly collection of the gas accounts, and recommending the Water Committee to agree to the substitution of a quarterly collection of the water accounts for the half-yearly collection at present in operation.

LEGAL INTELLIGENCE.

REINSTATEMENT OF ROADS AFTER MAIN-LAYING.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, Nov. 3.

(*Before Mr. Justice* DARLING *and a Special Jury.*)

King v. Barnet Gas and Water Company and Aird and Sons.

This was an action to recover damages for injury sustained by the plaintiff, occasioned by the alleged negligence of the defendants. It appeared that in January last the defendant Company were carrying out certain works in connection with the water-mains which run along Lyonsdown Road into the Station Road, and in so doing it was said they negligently filled in a trench in which the mains were laid where they crossed the Somerset Road West, so as to leave a ridge or mound some 4 to 6 inches above the level of the road, which was an obstruction to members of the public lawfully using the highway. The plaintiff's case was that she tripped over this ridge, and so occasioned the injury complained of. The defendants both denied that there was any negligence on their part; and the Gas Company further pleaded that if there had been any, Messrs. Aird were responsible for it.

Mr. DRUCQUER and Mr. CARTWRIGHT SHARP appeared for the plaintiff; Mr. RAWLINSON, K.C., and Mr. SCARLETT represented Messrs. Aird; and Mr. J. D. CRAWFORD, the Gas Company.

Mr. DRUCQUER, in opening the case, submitted that the accident was entirely due to the manner in which the trench was filled up. He said that if the work had been properly and carefully done, the contractors should have left a ridge of about 3 inches, properly rammed down, and have taken care day by day to see that it had not been disturbed by passing traffic. If a person fell over a ridge only 3 inches high, he would have no cause of complaint, as the work would have been done in a workmanlike manner. But in this case, the ridge varied from 4 to 6 inches. The defendants said the plaintiff was guilty of negligence in not having noticed the condition of the road; but, as the evidence would prove that the road was badly lighted, he did not think she could be accused of negligence.

His LORDSHIP said he did not understand why the Gas Company should have been joined as defendants, seeing that the persons responsible, if there was any responsibility, were Messrs. Aird.

Mr. DRUCQUER said they had joined the Gas Company as defendants because they were not aware of the exact position of the two parties.

Mrs. *J. A. King*, the plaintiff, was called, and stated that prior to the 17th of January she had seen the men opening the road, but had no particular reason to notice what they were doing.

In cross-examination, witness said she remembered the road being broken up on the 1st of January and finished on the 12th. She had occasion to go in and out every day, but not to cross the road before the day of the accident.

Dr. *A. Peringall*, who attended the plaintiff, described the nature of the injuries, and said his fee amounted to 14 guineas. His attention had been drawn to the condition of the road by being jolted when passing over it in his trap. He looked at the mound, and thought it was very rough; there being many loose stones on the top.

Mr. *W. T. Strather*, Surveyor, of Chingford, said he had had eighteen years' experience in the maintenance and management of roads. When a trench was reinstated, the highest camber that should be left was 3 inches, and the shape should be perfectly oval. The earth should be well rammed. Work was not properly carried out if there were loose stones left. It should be steam-rolled to prevent traffic displacing the top of the mound. If the height of the mound was from 4 to 6 inches, it was unsafe. He often had to complain of the way in which roads were made up. Granite and gravel should not be mixed. Granite was more binding than gravel, and would keep together very easily; whereas gravel depended upon the binding matter which filled up the interstices.

In cross-examination, witness said a good road could be made with gravel. It was his duty to look after excavations in the road; but he did not go about looking at trenches in other districts. Messrs. Aird and Sons were a good firm, and had had considerable experience in this class of work.

Re-examined: Big contractors required looking after as much as small ones. He had sometimes had to steam-roll Messrs. Aird's work, and charge the Gas Company with the cost of doing so. In this instance, the road should have been steam-rolled.

Mr. *King*, the husband of plaintiff, generally confirmed the evidence given by her.

Friday, Nov. 4.

On the resumption of the hearing this morning,

Mr. *King* said he examined the ridge, and found it was in a very rough condition. The level of the stones started at 2 inches and rose to 5 or 6 inches. The shape of the mound was anything but a nice, even curve. On the top were a lot of loose stones.

Several other witnesses were called to speak to the rough condition of the road; one being Mr. *Crompton*, the Chairman of the Highway Committee of the Barnet District Council, who said he brought the matter before the Council.

Mr. CRAWFORD submitted that there was no case for him to answer. The Gas Company had statutory power to open the road; and there was no suggestion that the Contractors employed were not competent to do the work.

His LORDSHIP said he would reserve the point until after the evidence had been given.

Mr. CRAWFORD then addressed the Jury. He said it was no doubt a great inconvenience to people to have the streets disturbed. But life could not go on without gas and water; and Parliament had given the suppliers of these necessaries statutory powers to break up streets in

order that the pipes might be laid down. The defendant Company, having these statutory powers, employed competent contractors to do the work; and they reinstated the road in the best known manner. It was probable the accident was caused by the lady stumbling over a loose stone, and not by tripping over the ridge. Before the Company could be held liable, the Jury must be satisfied that they were responsible for leaving the road in a dangerous condition.

Mr. SCARLETT said his clients were a firm of the very highest standing, having had great experience in the particular kind of work in question. If the case had to be decided on sympathy instead of evidence, the verdict would, no doubt, be for the plaintiff; but it was for the Jury to say whether or not the work had been carried out in a negligent way. It was impossible to replace the road in its original state. All that could be done was to do the work in a reasonable and substantial manner. His evidence would show that in no place did the ridge exceed 3 inches in height. The work was done under the supervision of the Engineer of the defendant Company and the Surveyor of the District Council.

Mr. *Frank J. Martin*, Assistant-Engineer of the Company, said it was his duty to superintend the laying of mains, but not to inspect the work, though in passing to his home he looked at the trench, and saw nothing the matter with it. On the day of the accident he measured the ridge, and found it to be 2 inches high in one of the worst places he could see. It was only natural there should be several loose stones about, but not more than one would expect to find after a road had been relaid. The road was well lighted; there being a lamp of 80-candle power close to where the accident happened.

In cross-examination, witness admitted he had made a mistake in saying he measured the ridge on the day of the accident. It was not till the 20th, when the Council informed the Company that an accident had happened. The gravel should be put in first, and granite on the top. The District Council complained that Messrs. Aird had not done this, but had mixed the granite and gravel. He did not agree with the evidence already given that granite and gravel would not bind.

A labourer in the employ of the Company said he inspected the road after Messrs. Aird's men left, and found it in good condition. There was no ridge at all.

Mr. *Henry York*, Surveyor to the East Barnet Valley Urban District Council, said he saw the road daily after it was relaid, and found the trench had been properly made-up. It was not correct to say there was a ridge of from 4 to 6 inches. When first completed, it would not be more than 3 inches high at any part, and at the time of the accident not more than 2 inches. Had there been any obstruction, he should have reported it to the Company or to Messrs. Aird. It was impossible to keep the granite and gravel separate; and he requested the Contractors to take off the top surface and relay it with granite.

In cross-examination, witness said he had no recollection of Mr. Crompton making a complaint at the Council meeting. The road was not steam-rolled after it was relaid.

Mr. *F. E. Andrews*, Manager to Messrs. Aird, said he received notice of the accident at the end of January. He at once went to the spot, and found that it was well lighted. In the Metropolitan area, Messrs. Aird laid from 150 to 200 miles of pipe every year, and they had never had an accident similar to the present one.

Mr. *Charles Maunders*, Messrs. Aird's superintendent for pipe laying in the North of London, said the depth of the trench was about 3 ft. 2 in. The subsoil was clay, upon which was a thin coating of gravel and granite. The ground was well rammed when the trench was filled in. Special care was exercised; and the road was attended to daily after the work was done. The ridge was about 2 inches high in the centre.

George Jackson, foreman ganger in the employ of Messrs. Aird, said special care was taken in laying the main in question, having regard to the slope. After the pipe was down, the clay was put back and rammed with an iron rammer, then the gravel, and on the top the granite. A man was sent over the trench with a broom for several weeks after the work was completed. It would not be right to pass a steam-roller over the trench for fear of damaging the pipe. The ground should be allowed to consolidate.

Mr. *J. C. Radford*, Surveyor to the Wandsworth Borough Council, said the work had been done in a thoroughly proper manner. In his opinion, it would have been very unwise to allow a steam-roller to be passed over the road, considering the size of the pipe and the shallowness of the trench.

Mr. *P. J. Bright*, Manager to an estate agent at New Barnet, said he remembered the road being opened; and after it was reinstated he noticed nothing wrong with it, though he drove over it daily in a motor.

Dr. *Norton* thought the plaintiff's injury was quite consistent with her having slipped on a loose stone. Had she tripped over a ridge, she would have fallen forward and fractured her thigh, not her left ankle.

Counsel having addressed the Jury,

Justice DARLING summed up. He said in order that the plaintiff might recover, she must satisfy the Jury that one or both of the defendants were guilty of negligence in doing the work in question. The defendant Company had a right to open the road to perform a statutory duty; and if the Contractors employed properly made-up the road, they could not be held responsible for the accident.

The Jury, after deliberating in private for three-quarters of an hour, returned into Court and said there was no prospect of their agreeing. Under these circumstances, his Lordship discharged them.

POISONED BY CARBON MONOXIDE.

Claim against the Corporation of Rochdale.

At the Rochdale County Court on Friday, before his Honour Judge Bradbury, an action was heard in which compensation was sought from the Rochdale Corporation by the daughter of Thomas Harris, who lost his life by the inhalation of carbon monoxide gas while working in a culvert which the Corporation were constructing in Newgate, Rochdale. It was stated for the applicant that Harris and two other Corporation employees descended the culvert, and three-quarters-of-an-hour later were found "gassed." Harris died the same evening, and William Clegg succumbed on the following day. The third man, named Collins, was not yet able to resume work. The blood of Harris was analyzed; and it was found to contain a sufficient quantity of carbon monoxide to account for death. It was urged by Counsel for the Corporation that the injury did not arise out of the men's employment; and that it was due to something outside the scope of their employment. John C. Shaw, foreman in charge of the work at the culvert, said that when Harris came out of the culvert he "looked like a man who had been in a very bad fog." Witness at once examined the culvert, and found in it a yellow vapour. He believed there was a gas-engine in the vicinity which discharged gases into the culvert. After hearing the medical evidence, Judge Bradbury said the only point raised for the defence was that the accident did not arise out of the employment. He failed to see how such a defence could be established. Here was a case of a sound man going into a culvert and coming back practically dead. He ruled that the accident did arise out of the employment, and awarded the plaintiff £300 and costs.

AFFAIRS OF E. O. PRESTON.

In the "JOURNAL" for the 25th ult. (p. 275), it was stated that the previous Friday's "Gazette" contained an announcement that a receiving order had been made under the Bankruptcy Acts in the case of Edward Oxenford Preston, described as a financier carrying on business at Tokenhouse Buildings, E.C. The circumstances under which Mr. Preston's name has frequently been mentioned in the "JOURNAL" will be fresh in the recollection of readers.

The first meeting of creditors took place at the London Bankruptcy Court last Wednesday, when Mr. E. S. Grey, the Official Receiver, reported that the debtor had stated, when before the Examiner, that he had carried on business under the name of E. O. Preston and Co. for twenty-seven years, at Tokenhouse Buildings. Latterly he had been principally engaged in financing and floating water-works, gas, and other companies, and had undertaken contracts up to £50,000. He had carried through important ventures, and in the past had made large profits; but, owing to the unsettled state of affairs, it had become increasingly difficult to do this, and in many cases he had made considerable losses. He was now indirectly interested in a contract with the South Lincolnshire Water Company, of Spalding, to carry water to Sutton, a distance of 21 miles; also in a contract with the Bungay, Eye, and Halston Water Company, of Bungay, to bore for water. His unsecured liabilities amounted to about £27,000, and were principally in respect of money due to sub-contractors for materials supplied, for loans, and for guarantees. From time to time he invested about £26,500 in land and property at Cookham, where he resided, and had since mortgaged the properties. His other assets were debentures in water-works and gas companies, now held as security for loans, and debenture moneys payable under contracts. The most direct cause of his failure was loss arising from his loans of about £16,000 to various gas and water companies without security. He advanced the money to protect the interests of clients; and some of the companies had gone into liquidation. He had also been interested in the promotion of several electric theatres, and made substantial profits therefrom.

Mr. R. Barnes attended the meeting on behalf of the debtor, and, in the absence of any offer, Mr. Owen Walker, C.A., of St. Stephen s Chambers, Telegraph Street, was elected Trustee to administer the estate in bankruptcy, assisted by a Committee of Inspection.

A Deal in Incandescent Mantles.

At a sitting of the Salford County Court last Wednesday, before his Honour Judge Stanger, K.C., a case was heard in which the Perfect Mantle Company, Limited, of London, sought to recover from Harry Taylor, incandescent gas-mantle merchant, of Salford, a sum of £66 for goods supplied. There was a counter-claim for £17 10s., said to be loss of profit on a certain transaction, owing to the plaintiff Company having supplied him with mantles which proved to be unsatisfactory. When the case was called, the defendant Taylor admitted the liability for £66, and judgment was entered for the plaintiffs for this amount. Mr. Jessel Rycroft, who appeared for Taylor, said, with regard to the counter-claim, that the mantles supplied to the Corporation for street-lamps by his client were found to be unsatisfactory; and, as a consequence, the Corporation cancelled an order for 100 gross of mantles given to him. In the witness-box, Taylor said a Corporation official told him in the presence of a representative of the Perfect Mantle Company that the lights gave out less brilliancy after three days' use, and were unsatisfactory in other ways. He wrote the Company on the subject, and received a reply saying that the complaint had been forwarded to the works. Dr. Atkinson, for the Company, submitted there was no evidence that Taylor had obtained any orders from the Corporation except two for 25 gross. William Clarke, foreman in the Lighting Department of the Salford Corporation, said that last year they handed Taylor an order for 25 gross of mantles; but they did not give satisfaction. A second supply was sent, and these also proved to be unsatisfactory—being easily damaged by the vibration resulting from street traffic, and also by the weather. In October of last year, the department communicated with Taylor to the effect that he would receive no further orders from the Corporation. The Manager of the Perfect Mantle Company gave evidence showing that there was a distinct understanding between the Company and Taylor that if any of the mantles were not satisfactory, he was to return them. His Honour said there was no evidence that Taylor had received an order from the Corporation for 100 gross of mantles; and he gave judgment for the Company with costs.

Messrs. Falk, Stadelmann, and Co., Limited, have appointed Mr. G. Falk as Manager of their Glasgow branch, in succession to the late Mr. A. C. Taylor. Mr. Falk has been connected with the house for the past ten years, and so has an intimate knowledge, technical and administrative, of the various departments of the business.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. J. HORSLEY PALMER in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting, and the following report of the Directors.

The Directors have pleasure in reporting on the results of the Association's operations during the half year ended June 30, 1910.

The profit of the half year was £269,149. This, together with the sum of £9698, brought forward from the account of the previous half year, makes a total of £278,847 available for appropriation, as compared with £271,044 for the corresponding half year of 1909. Inasmuch as the profit for the first half year of 1909 included the profit earned by the Frankfort Station in the first quarter of that year, before it became incorporated with the reconstituted Frankfort Gas Company, the results of the past half year were really better than these figures would indicate.

The total output of gas in the various towns supplied directly by the Association shows an increase for the half year at the rate of 4·46 per cent.; and the number of consumers, an increase at the rate of 9·89 per cent.

The total number of meters in use at the close of the half year under review was 508,845, of which 130,986 were prepayment meters. At the end of June, 1909, the total number of meters placed was 472,085, which included 115,838 prepayment meters.

The total length of mains laid up to June 30 last was 2296 miles; representing an increase of 67 miles since Dec. 31, 1909.

The gross cost of coal was 10½d. a ton less than in the corresponding half year of 1909; but this advantage was more than counterbalanced by the fall in the value of coke. The average value derived from tar was much the same as in the corresponding half year; but the returns obtained from ammoniacal liquor and its products showed some improvement. The net cost of coal increased by 1·94d. per ton.

The new retort-house at Aix-la-Chapelle, containing four benches of vertical retort settings, was completed, and put in action with satisfactory results.

At Berlin, the 5½ million cubic feet gasholder on the Schöneberg works was completed.

Progress was made with the erection of a new house for vertical retorts on the Holzmarktstrasse works, and with the enlargement of the apparatus house on the Mariendorf works.

At Brussels, satisfactory progress was made with the construction of the electricity station at Droogenbosch; and a contract was concluded for the exclusive supply of gas and electricity in the commune of Woluwe St. Etienne—a suburb lying north-east of Brussels—until the year 1948.

At Flushing, the new retort-benches were completed, and a contract was concluded with the suburban commune of Koudekerke, securing to the Association the monopoly of the supply of gas until 1960.

In view of the fact that the Association's contract with the Municipality of Vienna for the supply of gas to the suburbs on the west bank of the Danube expires on Dec. 31, 1911, when the business will be taken over by the Municipality, it was deemed desirable that an arrangement should be come to by which the Municipality should also take over, at the same time, by purchase, the gas supply of several smaller and less important suburbs on the eastern bank of the river, with which the Association also has contracts of varying duration. The Directors have the pleasure to report that this has been accomplished to the satisfaction of both parties.

The gas contract with Houplines, a suburb of Armentières, supplied by the Cie. Continentale du Gaz, was prolonged from 1920 to 1950.

In conclusion, the Directors desire to draw the attention of the proprietors to the accounts for the half year ended June 30 last, and to the balance-sheet. These have been duly audited; and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 4½ per cent. for the half year ended June 30, 1910, payable, less income-tax, on and after Tuesday, the 8th inst.

Scheme for Division of Profits of Half Year ended 30th June, 1910.

Balance brought forward from last half year . .	£9,698 1 10
Profit resulting from the workings at the stations, and dividends on investments, less interest on debenture stock, and the charges on account of depreciation and income-tax	269,149 12 2
	£278,847 14 0
Dividend of 4½ per cent. for the half year . . .	£222,300 0 0
Credit to pension reserve	40,000 0 0
Balance carried forward to next half year . . .	16,547 14 0
	£278,847 14 0

DIFFICULTY OF COMPARISON, BUT GOOD PROGRESS.

The CHAIRMAN moved—"That the report of the Directors upon the affairs of the Association, which has been read, be received and adopted, and entered upon the minutes." In doing so, he said: When I come to the November meeting to speak to you upon the affairs of the Association, I generally find myself in a somewhat difficult position, because a six-monthly interval since the last meeting is in no way adequate for a proper survey and comparison of our working; and to-day it has been rendered somewhat more difficult because of the changes that have necessarily been brought about in the Association's returns and statistics by the separation of the Frankfort branch (to which I fully alluded in my speech in May last), and also by the new system we have adopted of taking up meters. These changes entirely preclude any direct comparison of one year with the other; and not only with regard to the details of revenue received, and the amount of gas sold, but also in respect of the profit shown by the balance-sheet covering the period under review. You probably have noticed in one of the first paragraphs of the report that the Directors say: "The results of the half year were really better than these figures would indicate." I should like to give you an example of what these words mean. The accounts of the Frankfort Gas Company (in which you know we are now largely interested) are made up annually from April 1 to March 31, and they are only submitted once a year; and, for the past year, they were submitted to the proprietors in August, when a dividend of 10 per cent. was declared. The result on the Association's finances is that neither during the second half of 1909, nor during the half year which we are now considering, did we receive any interest on our investment in the Frankfort Gas Company. Therefore, the whole of that dividend (which represents a sum of £37,000) will have to be included in the current half-year's accounts. Now, although I have said that exact comparisons are most difficult, still we are able to report to you the splendid progress this old Company continues to make. We can point to a very large addition to the number of meters fixed, to the many miles of additional mains laid, and also to the considerable addition to the total volume of gas sent out. So that you see progress is being made steadily in almost every direction. We have an increase of nearly 20,000 meters placed in the half year, and the past half year was not what can be called a favourable one for gas, because the winter months were abnormally mild. Still it shows that our people and staff have plenty of energy for pushing our business; and it also indicates that the public appreciate the value of gas both for lighting and heating. Of course, when we speak of this large increase in consumption in the warm winter months, we have to look on the opposite side of the question; the warm winter months having a distinctly prejudicial effect on the sale of our principal bye-product—coke. Prices fell; stocks increased. And the result was that the value of coke diminished largely. But as the report states, owing to our purchasing coal judiciously, the extra cost was only about 2d. per ton more than in the first half of 1909. I am glad to say that, since the close of the half year, a demand for coke has set in at some of our stations; and we are selling the stocks at a better price than has been lately ruling.

THE RELATION OF PERCENTAGE INCREASES TO VOLUME.

A few days ago I was reading again the comment that appeared in the "JOURNAL OF GAS LIGHTING" on my speech to the proprietors in May last. The writer of the leading article asked me if I could not give some information as to what an increase of 5 per cent. in the Association's gas business—an increase which we have been in the position to report to you nearly every half year now for some time past—represented in volume on the consumption of ten and twenty years ago, as compared with that of to-day, making allowance for the stations that have been severed from the main body. Taking the first period, 5 per cent. represented in volume 198 million cubic feet for the half year; for the second period, it represented 244 million cubic feet in a half year; and now in the third period—that was, the second half of 1909, the period covered by the remarks of the writer in the "JOURNAL"—without Amsterdam, the inner district of Vienna, Haarlem, the French stations, and Frankfort (which have been separated from the Association, and whose total make represents 2,681,000,000 cubic feet per half year), the 5 per cent. increase represents no less than 279 million cubic feet. Personally, I do not think that to talk about millions of cubic feet is of any interest, except to the expert in gas matters; but a much simpler example of marking the progress of the Association's work is to state that, during the first half of 1910, notwithstanding the limbs which have been cut off from the Association, we carbonized no less than 483,500 tons of coal, or over 100,000 tons more per half year (notwithstanding the fact that the carbonizing returns show that we are extracting above 900 cubic feet of gas more from each ton of coal) than we did twenty years ago.

THE SITUATION IN VIENNA.

In the report of the Directors, there is a brief reference to an arrangement with Vienna, regarding which I should like to give you a few explanatory words. The Association has two distinct and separate businesses in Vienna. The larger one is on the right bank of the Danube, and there 100,000 tons of coal are carbonized yearly; while the other is in the commune of Floridsdorf on the opposite, or left, bank of the Danube, where only 10,000 tons of coal are carbonized annually. The conditions to be observed on the cessation of the concession for the larger business are fixed by the contract we entered into with Vienna, and which expires in 1911; while the arrangements referred to in the report are chiefly concerned with the smaller business from the Floridsdorf works. From these works the Association not only light Floridsdorf, but a number of communes in the vicinity. These communes were incorporated not long ago in the City of Vienna, which contested the validity of the contracts that we had made with them. The Board thought the Association had a very strong case. But we also considered it politic to come to some arrangement with the authorities; and the negotiations have come to a successful issue. The Association will give up their business from Jan. 1, 1912; and the city will buy, on expert valuation, the whole of the plant and materials outside the works—that is, the mains, services, meters, public lamps, &c. In addition, the considerable sum of £29,000 odd is to be paid as compensation for loss of profits. The general position on Jan. 1, 1912, therefore, will be that the Association cease all active operations in Vienna, but remain in possession of the valuable sites occupied by the works and offices. A pleasing feature of the negotiations is the friendly way in which they were conducted by the authorities. And a proof of the readiness of the authorities to assist and meet the Association is furnished by the fact of their having agreed to supply us with gas in bulk from the municipal gas-works, in the event of the output from the Association's own works proving insufficient to meet the demand during the remaining term of the contract in our own area of supply. Of course, by this arrangement with the Corporation, the Association will realize a portion of their assets; but the proprietors must not lose sight of the fact that such realization cannot compensate the Association for the loss of profits which are at present derived from our business in Vienna.

"LESS INCOME-TAX."

I come now to the last paragraph in the report, which refers to the dividend, and which probably is the paragraph which interests the proprietors more than any other. I daresay you will expect me to say a few words upon the change which has been made in the system of

paying the dividend. Two questions may be asked me. One is why the Directors have increased the dividend; the other is why we have chosen to deduct the income-tax. We have proposed the increase because we have fairly earned it, and because we have, after mature reflection, thought we shall be able to maintain it. That is the principle this old Company (which has been in existence for over 85 years) has adopted from the very commencement. The Directors have never suggested an increase of dividend which they did not think they could maintain in the future; and I sincerely trust we shall be able to maintain it, unless some very extraordinary upheaval on the Continent (such as a war) occurs. It is for that reason—because of our belief—that we have suggested an increase in the dividend. Now I come to the more knotty question perhaps, which has been agitating the minds of some of our shareholders, as to the deduction of the income-tax. Still in this we are only falling into line with all the great commercial and industrial companies of the present day. In my own case, some of these companies have paid me my dividends free of income-tax; but now they write and tell me that in future I shall have my dividends with income-tax deducted. When income-tax was only 2d., 4d., or 6d., it did not much matter about dividends being paid free of income-tax; but now we have come to 1s. 2d. I think that really everybody ought to realize, through his dividend warrants, the great incidence of taxation which has been imposed upon this nation. I also think that the true capital value of our stock is never quite realized on the Stock Exchange. They merely say it is 4 or 4½ per cent. for the half year; and they do not pay sufficient consideration as to whether it is paid free of income-tax or less income-tax. This is the opinion that has been expressed to me by several leading members of the Stock Exchange. And there is another thing. The public, or perhaps I ought to say some fortunate members of the public, have to make a return of their income to the Chancellor of the Exchequer, so that they may pay a super-tax; and this change will simplify their returns in a very material degree. In consequence of the large number of letters we receive annually at the office on the question of income-tax, the Secretary has begged me to take this opportunity of reminding the proprietors that annexed to each dividend-warrant there will be a certificate to the effect that income-tax has been deducted and specifying the exact amount that has been deducted; and he hopes that I will urge all those proprietors who are entitled to reclamation or rebate, to make the necessary claim to the Inland Revenue for the return of the amount due to them. Proprietors must bear in mind to preserve their income-tax certificate, as it will be required by the Inland Revenue Authorities when claim is made. I must express my regret that our foreign proprietors have had the privilege of reclamation of income-tax taken away from them by the Finance Act of 1910. It inflicts a hardship on those who do not enjoy the advantages of British citizenship while having to contribute to the nation's funds. I can only hope that at some future date we shall see this injustice remedied.

THE BALANCE-SHEET—DEPRECIATED CONSOLS.

I want for a moment to turn to the balance-sheet. The proprietors will notice that it has been set out in greater detail than hitherto; and it contains one important feature to which I should like to allude. Proprietors who have made it their business to study the balance-sheets for some years past will remember that the existence of the reserve fund investment of £400,000 Consols was formerly mentioned in the following footnote to the balance-sheet: "In addition to the above, the Association possess £400,000 Consols as a reserve fund." But it was not incorporated in the balance-sheet figures. In 1906, you will remember the depreciated value of this reserve was mentioned; and it was not then thought necessary to take action in the matter. The reserve fund investment was allowed to remain in our books at its original cost. Since then the price of Consols has gone from bad to worse, until we now have the nation's premier security standing at a price of about 79½. In these circumstances, the Board have decided that it would be unwise to delay any longer making some provision to meet this depreciation. They have therefore first taken the sum of £2664 6s. 2d. to bring up the reserve fund to £400,000 on the left-hand side of the account; and they have also taken from the profit of the half year a sum of £17,335 13s. 10d. for writing-down the £400,000 Consols which stood at £397,335 13s. 10d. to the book value of £380,000. In order to make good this reduction, we have transferred to the reserve fund investment £24,000 Consols of the book value of £20,000, and forming part of £80,000 Consols hitherto included in the Association's general investments. The fund is now therefore represented by £424,000 Consols at £400,000. At this figure the price averages £94 6s. 10d.; and the Board propose to continue the process of writing-down the investment half year by half year until it stands at a price more in accord with its market value. This treatment of the reserve fund investment is set out fully in the balance-sheet.

CAPITAL EXPENDITURE AND PROGRESS.

The only other item in the balance-sheet which calls for comment is that of works and mains. If you compare the balance of £4,729,158 with the balance on the corresponding date of £4,375,511, it will be seen that, during the past twelve months, the total expenditure upon works and mains has amounted to £353,647. This is only another evidence of the progress the Company is making. This is necessary expenditure. Every gas company having works in different countries and towns, where great building is going on, is obliged to spend huge sums of money on extensions which for the moment do not return their proper rate of interest towards the revenue, but which are absolutely necessary for the future well-being of the Company.

VISIT OF THE SENIOR AUDITOR TO THE PRINCIPAL STATIONS.

This is all I am going to say to you to-day with regard to the accounts and the business of the Association for the half year under review. But it is usual for the Chairman to mention anything of importance that may have happened since June 30. A matter of interest which I should like to mention is an entirely new departure, or perhaps I should call it an innovation. It was the visit of your Senior Auditor to several of the most important of the Association's stations. Mr. Gurney Fox, with the zeal which always characterizes his actions for the benefit of the proprietors in auditing the accounts and looking after their interests, approached the Directors to know if he might visit the most important of the stations, and go closely into the system of accounts and the system of inspection that we employ on the Continent. The Directors were most happy to give him every facility in this service, because there is nothing to conceal in our business; and we believe that our system of accounts and inspection is as perfect as that of any big industrial establishment to be found on the Continent. I am glad to see Mr. Gurney Fox present to-day; and perhaps, after the routine business has been disposed of, he will kindly say a few words as to what he found on the Continent with regard to the accounts of the Association.

DIRECTORS' VISITS TO THE STATIONS.

Lastly, I have to allude to the Directors' visits to the Continent, which always take place during the autumn. Sir Charles Jessel has visited several of our most important stations. Mr. Lucas has also been abroad on your behalf. Colonel Le Roy-Lewis has been to various towns. Mr. Wilkinson has visited a great many of the stations; and I have taken my share in visiting a number of the smaller French stations. I am glad to be able to report that everything is in excellent order; and our works are fully equipped to meet the demands which we hope will be made upon us for a plentiful supply of gas during the coming winter.

Mr. ARTHUR LUCAS seconded the motion.

Sir JOHN RUNTZ congratulated the Board upon the continued progress of the Association. He saw that in the corresponding half year they made £242,396 profit; while in the past half year they made £269,149—being an increase of £26,753. This was extremely satisfactory. The Chairman had referred to the question of investments and to the large loss on Consols. It was a considerable item; but they had to face the loss. Lower down in the balance-sheet would be found the heading, "English, Colonial, and Indian securities," the market value of which on June 30 was £413,238; while they cost £401,344, or an appreciation of £12,000. He ventured to think that if the Directors had acted a little more vigorously a year or two ago, and placed some of the reserve fund in Colonial stocks, they would not have had this large loss in Consols. No one could blame the Directors for investing in Consols, and no one could have foreseen the deplorable price at which they stood to-day. They all hoped that the price of Consols, for the nation's sake and credit, would soon be altered. Fortunately the Association could face this loss; and it did not affect them very seriously. He proceeded to speak against the deduction of income-tax from the dividends, and expressed the opinion that shares or stock with dividends paid free of income-tax stood in a more favourable, or more popular, position than those with the income-tax deducted. Personally, he would rather have a dividend of 4½ per cent. net than 4½ per cent., less income-tax. He hoped (it was too late to be altered this year), the Directors would reconsider the matter; and return to the old condition of paying the dividend free of income-tax.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Sir E. CHANDOS LEIGH, a dividend of 4½ per cent. on the £4,940,020 of stock, less income-tax, was declared.

The CHAIRMAN moved a vote of thanks to the staff and agents of the Association. The agents, he remarked, exercised very responsible duties on the Continent; and they were their trusted local representatives. They had the pleasure of seeing present Mr. Delbrück, the well-known banker of Berlin, who succeeded his father some years ago, and on whose shoulders had fallen most worthily the mantle of his illustrious sire. He (the Chairman) could assure the proprietors that Mr. Delbrück was devoted to the interests of the Association, and did his very utmost to advance the interests of the Association in Germany.

Colonel H. LE ROY-LEWIS seconded the motion; and it was heartily agreed to.

Mr. J. GURNEY FOX, at the invitation of the Chairman, referred to his visits to some of the more important stations. He was grateful to the Directors for allowing this innovation; and he was also exceedingly indebted to the managers and engineers at the various stations. Thanks to their kindness and courtesy, he was able not only to see closely into the accounts and the inner workings, but they took the greatest trouble in showing him over the various works. He was also fortunate in being accompanied by one of the inspectors of the Association, who made everything so simple and clear to him. They examined very carefully at the different stations—Antwerp, Berlin, Hanover, Brussels, and Aix-le-Chapelle—into the systems of accounts, and went into the carbonizing accounts, wages-sheets, meter takings, stock, and, in fact, into everything that would be of assistance. He could as the result say that a more thorough system of accounts, and a more thorough system of checking, he could not possibly conceive. What he saw at the works impressed him with the feeling that everything was up to date in connection with their plant, and that the work was being economically done. Further he saw that everything possible was being done for the welfare of their men, who appeared to be thoroughly happy and contented, and earnest in their work. He was glad to find, too, that they had one day's rest a week. From all he saw, he felt confident that progress and dividend would be maintained, and that the proprietors might congratulate themselves upon the position of the Association.

Mr. DELBRÜCK thanked the Chairman very much for the complimentary remarks made in regard to himself (the speaker), and also the proprietors for the kind reception they had given to the remarks.

An acknowledgment of the services of the Chairman and Directors terminated the proceedings.

Paignton Water-Works Extension.—It is proposed by the Paignton Urban District Council to apply to Parliament in the ensuing session for powers to duplicate the water-main from the reservoir on Dartmoor. The works are of quite recent construction; but the need of additional means of supplying the water has already been felt. Plans of the intended works have been made by the Water Engineer to the Council (Mr. J. C. Hawkins) and forwarded to Mr. Baldwin Latham, who will be the Consulting Engineer for the work.

COLONIAL GAS ASSOCIATION, LIMITED.

A Coal Strike, but a Good Financial Position.

The Annual General Meeting of the Association was held last Tuesday at the London Offices, Suffolk House, Laurence Pountney Hill, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. A. J. Kingdon) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN, in moving their adoption, said it was with much regret that they had to announce the death of their London colleague, Mr. A. Godwin Hammack, which took place on Sept. 19. On the directorate Mr. Hammack succeeded his father, the first Chairman, in 1894. Shortly after the last annual meeting, he was taken ill; and, as mentioned, passed away a few weeks ago. The Board, at their last meeting, sent a letter of sympathy and condolence to his family; and he was confident the shareholders would confirm what was done, as they all regretted his loss. Mr. Hammack was a most agreeable colleague, and attentive at all times to the duties of his office. As stated in the report, the Board did not think it necessary at present to fill the vacancy. It was now his pleasure to move that the report and balance-sheet be adopted; and, in doing so, it was most gratifying to be able to say that, notwithstanding the disastrous five months' coal strike in Australia, which cost the Association some hundreds of pounds, they were able to pay the same rate of dividend as last year, and to increase the carry-forward from £1068 to £1251, besides writing off for depreciation the sum of £997. At the last meeting, he was too optimistic in thinking that at this one the Directors would be able to increase the dividend; but had it not been for the lamentable strike referred to, there was no doubt it could have been done. As the great Disraeli once said, "It's the unexpected that always happens." However, it was a most thankful result of the year's working that they had come through it with such a favourable return, particularly as, during the last four or five months of the strike, they had to pay three, four, and five times as much for coal as the contract price. However, by so doing, they were able to keep up the supply of gas, and did not increase the price to the consumers. The prosperity of Australia, it was gratifying to report, was still increasing, and everything pointed to its continuance. Their Managing-Director (Mr. Swinburne) was sanguine that the current year's working would be of the most satisfactory character. It was the hope of himself (the Chairman) and of his colleagues that, at this meeting, they would see the shares at par or a premium; and he felt convinced this would soon be the case. The shares were very firmly held, as it would be noticed that only some fourteen transfers were passed during the year. In the notice calling the meeting, it would have been observed that there was a proposal to make some addition to the Directors' fees. This, it would be remembered, was the wish of the shareholders present last year. But as notice of it had not been given, it was thought better to defer it to this meeting. It was now 22 years since the Association started; and the fees were then fixed at £30 for each Director, and had remained at the same figure up to now, with the addition, according to the Articles of Association, of £100 for every 1 per cent. dividend paid beyond 4 per cent. Last year it was stated that the Municipality of Geraldton had given notice of their wish to purchase the works at the end of the concession in March last. The Managing-Director went to Geraldton, and came to an agreement with the Municipality for the sale. After going fully into the matter, the price of £12,000 was accepted; and the works were taken over by the Municipality on March 1 this year, with the understanding that the Association were to continue the working up to the time the payment was made, which was fixed for November—the Municipality paying the Association interest as it became due, and for the stocks of coal and other things that they agreed to take over, with an allowance for interest and management. Under the terms of the agreement, there was an arbitration clause; but it was not necessary to bring this into operation, as the sum arrived at was agreeable to both. The Directors were expecting to hear daily that the amount had been paid; and, when received, the Board would take into consideration how it was to be disposed of to the best advantage of the Company. The result would appear in next year's balance-sheet. It would be noticed that the expenditure of capital during the year amounted to £1886; and this was spent in connection with new mains, meters, &c. The debenture re-issue was about £2000 less; and this it would not be necessary to issue now, as, with the amount coming from the Geraldton works sale, the loan from the bank would be paid off. The stocks were about the same as in the previous year. The receipts from gas, including only eight months' working from Geraldton, showed an increase of £700, and for residuals £400. This result, with the reduced price for gas at several of the stations, enabled the Board to say that the trading of the past year was very satisfactory. The 11 per cent. increased sale of gas, they thought, would be accepted as an excellent result. The number of consumers obtained during the year had been 270. The prospects for the current year might be regarded as favourable; and he considered, supported by the Managing-Director's opinion, they might look forward with every confidence. In conclusion, the Directors thought, under all the circumstances mentioned, it was best to continue the same dividend (5½ per cent., free of income-tax), and to increase the carry-forward by £200. He felt confident the shareholders would consider the past year's working had been fairly good, and that the decision of the Board would meet with their approval.

Mr. CHARLES HUNT seconded the motion; and it was carried.

On the motion of the CHAIRMAN, seconded by Mr. WILLIAM C. PARKINSON, a dividend was declared for the half year at the rate of 7 per cent. per annum, free of income-tax, making, with the interim payment, 5½ per cent. for the year.

The CHAIRMAN said their two local Directors (Mr. Henry Andrews and Mr. George Swinburne, Managing-Director), retired on this occasion; and he had pleasure in moving their re-election.

Mr. FREDERICK R. SMITH seconded the motion, remarking that they were fortunate in having Mr. Swinburne as Managing-Director, and Mr. Andrews as a local Director.

The motion was unanimously agreed to.

Proposed by Mr. SAMUEL WHILE, and seconded by Mr. SAMUEL CUTLER, the Auditors (Messrs. Wood, Drew, and Co.) were then re-appointed.

Mr. JOHN COATES (Consulting Engineer in England to the Victorian Government) said that due notice having been given, possibly, as founder of the Company, it was fit he should move a resolution which he felt sure would be received by the shareholders unanimously. It was that the remuneration of the Directors should be a sum equal to £60 per annum, multiplied by the number of Directors for the time being, in addition to the provision made by Article 73 of the Articles of Association, and that the fees be paid free of income-tax. The shareholders who were present last year would remember that he then said that the Board was perhaps the most underpaid one in the City of London. He did not think this was the besetting sin of Boards generally. But in the present case it seemed to him that, for a long time past, they had been much underpaid. During all the years of depression in Australia, after the land boom, the Company suffered adversely with all the rest of the industrial companies there; and he could only assure the shareholders that this ship was steered safely, with marked ability and great care and economy, through very troublous waters. Now they seemed to be on the eve of better times; and the day had come when a change should be made in the Directors' fees. Most of those present (perhaps all) had seen that an able delegation, composed of the Hon. Hugh Mackenzie, Minister of Lands, and Dr. Elwood Mead, Chief of the Irrigation Department, from Victoria—where the Association had most of their works—was here recently; and he was looking forward with intense interest to the result of this delegation, because it would mean a closer settlement in the districts where their business was, and particularly at Shepparton and Wangaratta. It probably meant that where there were now ten families there would be a hundred, with perhaps 100 to 150 acres to each; the facilities the Victorian Government were giving just now being simply directed to getting the land occupied. This would represent increased wealth and population to the districts where they had little consumption. He looked forward to an era of prosperity for Victoria. On its eve they could not do better than pass the motion unanimously, and in this way thank the Directors for all they had done in times past. He felt sure they might expect they would do as well in the future as they had done in the past.

Mr. FREDERIC G. PAINTER, in seconding, said it was quite right for them to have gone on with the low fees while the Company were not paying what might be regarded as a fair dividend on such an investment; but now the shareholders were getting a 5½ per cent. dividend, £30 a year was not an adequate remuneration for Directors managing the concern—especially a concern doing business so far away. He would suggest that after the words "£60 per annum," they should insert "from day to day," so that, if a Director retired from the Board from any cause, there would be no possibility whatever of any question arising.

The suggested insertion was agreed to; and the resolution was unanimously carried.

The CHAIRMAN said the Directors were extremely obliged for this mark of the confidence of the shareholders. When the land boom came to an end in Australia, the 7 per cent. dividend that had been paid fell to 6 per cent., and then the 6 to 4 per cent., and next year to 3 per cent. These were troublous times; and they made the Board feel very anxious. But he was perfectly certain they were going to get into their old position. They had a sum equal to one-and-a-half year's dividend in hand, and this could be appropriated for any purpose for which it was required. He was reading that morning that there had been an increase of something like 3 millions of exports from Australia, and 2 millions from New Zealand. This showed that this part of the world was becoming marvellously prosperous; and in this prosperity their Company would share. Proceeding, he said that owing to the coal strike they had had an anxious time during the early part of the year. The strike continued for some five months; and their Managing-Director had had a difficult task to keep the stations going. The Association had twelve works; and eight to ten of them were affected by the strike. He might say that, if their friend Mr. Hunt had not helped them considerably, their loss would have been very much more. Melbourne being close to their works, they were able to get from there supplies of coal which had been sent from England. It had all ended very well, however; and they might congratulate themselves that they had had such a satisfactory year. He wanted the shareholders to send out a special vote of thanks on this occasion to the Managing-Director and his colleagues, and to the various station managers, for their services during the year.

Mr. PAINTER seconded the proposition, which was heartily carried.

Moved by Mr. PAINTER, and seconded by Mr. WHILE, a cordial vote of thanks was passed to the Chairman and Directors.

An acknowledgment by the Chairman concluded the proceedings.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held at the Offices, Ogle Road, Southampton, last Wednesday—Captain A. J. CORSE-SCOTT, J.P., presiding.

The CHAIRMAN said it gave him great pleasure to move the adoption of the report and accounts for the past half year. The stockholders would see that there was a sufficient sum standing to the credit of the profit and loss account to meet all charges, allow for payment of the maximum dividend on the ordinary stock, and leave a balance of £2426 to be carried forward. The sale of gas was still very satisfactory. Applications for supplies were being received every week. The demand for cooking-stoves during the past summer was exceedingly gratifying to the Directors; and they hoped that during the winter a large number of consumers who had not hitherto used gas-fires would avail themselves of the great variety that were to be obtained on hire at very low rentals. As the Directors expected, the decision of the Corporation to transfer the lighting of the street-lamps from the Gas Company to the Electricity Committee had resulted in an increased cost to the ratepayers. Notwithstanding that only about 500 lamps were transferred

at March 31—the greater portion of these lamps being taken over nearly at the end of the period mentioned—they would see, on referring to the published accounts of the town, that the total cost for public lighting for 1909-10 was £684 more than that of the previous year. In order to deal more effectively with the increasing work, new buildings were being erected to take the place of the old workshops, which were now totally inadequate for the requirements. Mr. Charles Crowther Smith, who for 39 years was Secretary of the Company, and since 1904 occupied a seat on the Board, passed away in June. By his death, the Directors lost a valuable colleague. During the long period he was connected with the Company, he rendered yeoman service; and it was to a large extent owing to the valuable service and sound judgment he brought to bear on the many matters concerning the welfare of the Company that it occupied the sound position it did at the present time. He would be greatly missed, not only by those connected with the Company but also by the town at large. The Directors had, after careful consideration, offered the seat to Mr. Joseph Cash, who had for some years acted as the Company's Consulting Engineer; and he had agreed to accept it on Jan. 1 next, after he had handed in his resignation of the office he now held. In securing Mr. Cash's services on the Board, the Directors felt sure they had obtained a gentleman who would be able to render excellent help to the Company. Mr. J. B. Paddon, who for many years held the position of Consulting Engineer, and who designed the greater portion of the Company's works, and also the offices they were meeting in, passed away recently. The Directors recommended, for the confirmation of the stockholders, an increase in the salary of the Secretary. In order to enable consumers to better understand the proper use of gas-cookers, the Directors had arranged for a series of cooking demonstrations to be given. The first lecture proved most successful. After Christmas, it was proposed to start a school of cookery.

The report was adopted, the payment of the maximum dividends was agreed to, and the salary of the Secretary (Mr. J. R. H. Jacobs) was increased from £400 to £500 per annum.

THE INCOME-TAX COMMISSIONERS AND DEPRECIATION ALLOWANCE.

The appeal of the Brixham Gas Company for allowance in respect of depreciation was heard on the 1st inst., before the District Commissioners at Paignton. The Company was represented by Mr. W. A. Schultz, Chartered Accountant, of No. 50, Cannon Street, E.C.

In this case, depreciation had been allowed for some years; and the assessment for 1909-10 had been made as before. But, subsequently to the issue of the circular by the Inland Revenue to surveyors, the latter had raised an additional assessment in the amount of the depreciation already allowed.

After hearing the arguments, the Commissioners decided to allow depreciation in accordance with the Customs and Inland Revenue Act, 1878, and the Finance Act, 1907; and the amount was fixed at 3 per cent. on the value of the plant and machinery.

MANCHESTER CORPORATION GAS UNDERTAKING.

A Criticism and a Reply.

Readers of the "JOURNAL" are aware that Mr. S. Norbury Williams exercises vigilant supervision over municipal affairs in Manchester; and in the "Manchester City News" for the 29th ult. he had a long article dealing with what he called the three important problems of the amalgamation of the city with Salford, the rectification of the ward boundaries, and the lighting quality of the gas, about which he, in company with many other citizens, was surprised to find so little had been said or written during the municipal contests. The views of the writer on the two first-named subjects are of no special interest to our readers; but his remarks on the last call for notice.

Criticism by Mr. S. Norbury Williams.

For long years the subject of the lighting quality of our gas has baffled us. I have myself endeavoured to elicit the information both by correspondence and at a recent public inquiry. But it was impossible to extract from the leading witness a clear statement as to the present candle power of Manchester gas; and the inquiry left us just as wise as we were before. I have inquired from members of the Gas Committee itself as to how our gas of to-day compared with that of ten or twenty years ago, and they have been unable to tell me. They were as much in the dark as I was myself. We have had cryptic, mysterious public statements made, that "the gas to-day is as good as ever it was." Then we have scanned the official figures, showing us the illuminating power in candles thus:

Year.	Candles.	Year.	Candles.	Year.	Candles.
1890	19·74	1903	18·25	1907	17·67
1893	19·11	1904	17·80	1908	17·53
1897	19·16	1905	17·04	1909	17·72
1900	19·40	*1906	15·30	1910	17·63

Every user of gas in Manchester must have noticed the great difference in the lighting power of our gas as compared with what it was years ago. My own belief is that the eyesight of thousands has been either damaged or utterly ruined by the reduced light of our gas. This is chiefly the case among our poorer consumers, who cannot afford incandescent mantles. I have received complaints from hundreds of them; and I am glad to notice that our friend Canon Nunn has called attention once more to the subject. The excuse of modern gas makers is that the calorific (or heating) properties of gas are now as important as their lighting properties, owing to the advent of gas-cookers, gas-engines, and so on. But our Manchester figures show the proportion of gas sold—

Ordinary consumers	76 per cent.
Automatic meter consumers	10 ,,
Gas-engines	7 ,,
Public lamps	7 ,,

Some years ago, the Gas Committee adopted a new standard by which to test our candle power. To indicate this in the official figures given above there is an asterisk before the date of 1906. To put it bluntly, it

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 385.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Oct 14	5	Alliance & Dublin Ord.	88 90	+1	5 11 1
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95–98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6⅞–6⅞*	..	5 5 8
40,000	5		7	Do. New, £4 paid	4⅝–5⅛*	..	5 9 3
50,000	10	Aug. 31	15	Bourne-mouth Gas and Water } 10 p.c.	28½–29½	..	5 1 8
311,810	10	,,	7	B 7 p.c.	16¾–16⅞	..	4 3 7
75,000	10	..	6	Pref. 6 p.c.	14⅞–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246–249	..	5 0 5
330,000	,,	,,	9⅜	Do. New	184–186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215–218	..	5 0 11
246,320	,,		8	Do. A Ord. Stk.	157–160	..	5 0 0
460,000	20	Sept. 29	10⅝	British	44–45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117–119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107–109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½–5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5⅛	Commercial 4 p.c. Stk.	105–108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101–103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79–81	..	3 14 1
800 000	Stk.	June 10	4†	Continental Union, Ltd.	80–100	−6	4 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104–105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103–105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¾–24¼	−¼	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17⅞–18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅝	Gas light and Coke } 4 p.c. Ord.	104⅝–105½	..	4 8 5
2,600,000	,,	,,	3⅛	3½ p.c. max.	87–89	..	3 18 8
4,062,235	,,	,,	4	4 p.c. Con. Pref.	103–105	..	3 16 2
4,531,705	,,	June 29	3	3 p.c. Con. Deb.	80–82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92–94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17–17⅛	..	6 5 8
131,070	Stk.	Sept. 15	7⅛	Ilford A and C	145–148	..	4 19 8
65,780	,,	,,	3⅛	Do. B	112–114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
4,940,000	Stk.	May 12	9†	Imperial Continental	183–190	+1	4 14 9
1,235,000	Stk.	Aug 12	3⅜	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 13 4
561,000	Stk.	,,	10	Liverpool United A.	220–222	..	4 10 1
718,100	,,	,,	7	Do. B	163–165	+1	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅜–4⅝	..	6 3 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	99–101	..	4 19 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 27	3⅜	Monte Video, Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	July 28	4⅛	Newc'tle & G'tesh'd Con.	102–103	..	4 5 0
529,435	Stk.	June 29	3⅜	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13⅜–14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138–140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd.	6–6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A.	131–133	..	5 3 0
60,000	50	,,	13	Do. B.	124–126	..	5 3 2
100,000	50	,,	12	Do. C.	117–119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102–104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼–7⅜*	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅜–5⅞	..	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15⅜–15⅝	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼–11½	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51–52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	Oct. 14	6	South African	10⅜–11½	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80–82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham A 5 p.c. and B 3½ p.c.	141–143	..	4 17 11
483,940	,,	,,	5⅜		112–114	..	4 16 6
149,470	,,	June 29	4	Edmonton 4 p.c. Deb.	57–59	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9⅜	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
230,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112–114	..	4 7 9
255,636	Stk.	Aug. 31	6¼	Wands-worth B 3½ p.c.	139–141	..	4 15 9
85,765	,,	June 29	3	3p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

looks as though they were now measuring our milk in a three-gill can instead of a two-quart one, as was previously the case. At any rate, we have now at last got at the fact which we have suspected for years, and that fact is that to-day our gas is 4 candles poorer than it was twenty years ago—that is, its illuminating or candle power is worse to that extent. Although many of us have long suspected this, I confess that the admission which has now been officially made almost staggers one. Four candle power worse than twenty years ago! The citizens ought to know this, and to make their arrangements accordingly. It affects most those who cannot afford to buy mantles. The poor suffer, as they always have to do. I may say that the price charged to consumers within the city twenty years ago (1890) was 2s. 6d. per 1000 cubic feet; the price is still 2s. 3d., in spite of the very serious fall in candle power. So we have not been doing such great wonders in the gas line, after all!

Those who were present at the last inquiry in the Town Hall on gas matters will remember what great efforts were made to elicit the plain facts as to the lighting power of our gas to-day, as compared with that power in years past. Questions were put in various forms, in order to bring out clearly the relative value of the former and the present method of calculating the candle power; but all to no purpose. The people who heard this questioning will be instructed and pleased when they now hear that Mr. J. G. Newbigging, the Chief Engineer of our Manchester Corporation Gas-Works, when giving evidence before a House of Commons Committee on the 7th of July last, admitted that there is no prescribed quality or price of gas in our city. "Since 1889," said he, "the illuminating power of the gas has been gradually reduced by about 4 candles." It was not because of want of "pluck" that the reduction was gradual, or even to prevent the consumer finding the thing out. So said the Engineer. Well, we are glad to know the real fact at last; and I can only hope that our citizens (the poor especially) are pleased and satisfied now that they know of a truth that the gas they are burning in 1910 is 4 candles worse than it was in 1890.

Reply by Mr. J. G. Newbigging.

The following reply by Mr. J. G. Newbigging appeared in the "Manchester City News" last Saturday.

Mr. Alderman Gibson [the Chairman of the Gas Committee] intended replying to the article of Mr. Norbury Williams in your last issue; but inasmuch as reference has been made to me and to technical questions, he has been good enough to consent to my replying in his place.

The facts of the case are not quite as stated by Mr. Norbury Williams. At the Local Government Board inquiry held on May 3, 1907, with reference to the application of the Gas Committee for a loan of £300,000, the reason for the change of test-burner and consequent lowering of the candle power of the gas was fully explained; but it appears necessary to traverse the ground once more.

For many years, down to 1906, the Gas Committee had voluntarily penalized themselves by continuing to test their gas with a flat-flame burner—a statutory test unknown in the gas industry with any gas of a prescribed illuminating power lower than 20 candles, and a most exacting test owing to the cooling and over-oxidizing effects of an unrestricted supply of air to the burner, which prevents the full value of the gas being recorded on the photometer. This test had been continued by the Gas Committee in spite of the fact that the undertaking is under no obligation in any of its Acts of Parliament to have any illuminating power test whatever.

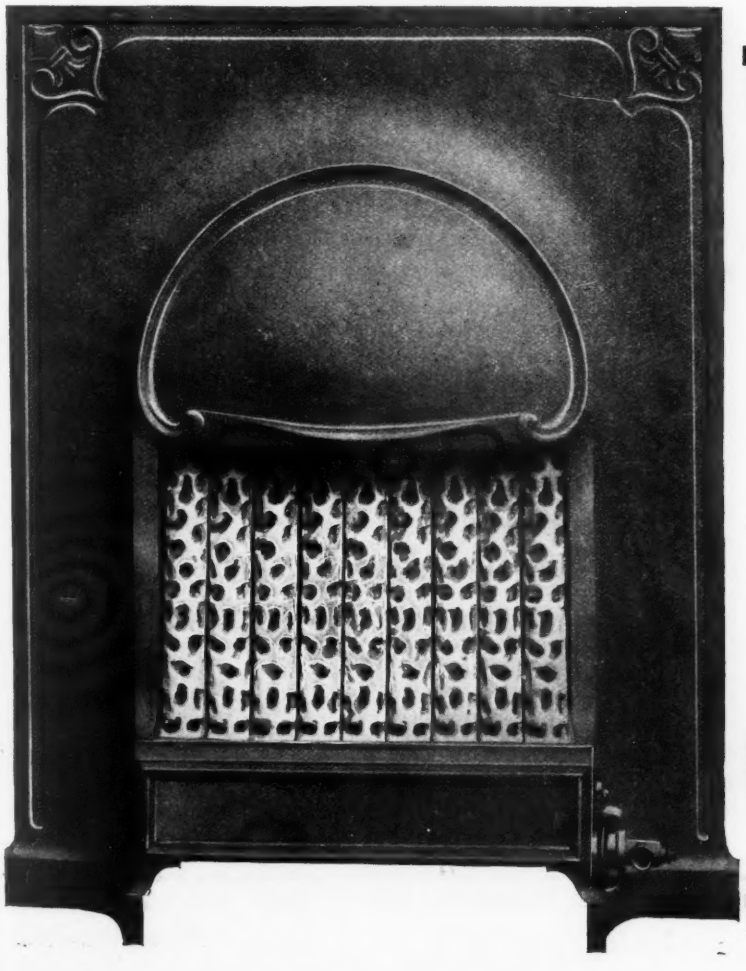
The Chairman of the Gas Committee (Alderman Gibson) was, however, so anxious that the gas consumers should have the best possible gas supply suitable for the consuming appliances then available, that he continued the test so long. On my pointing out to him the changes that had taken place in the methods of consuming gas, and that the Manchester gas undertaking stood in an invidious position as regards the illuminating power test with every other undertaking in the kingdom, he decided to advise the Committee to adopt the latest test-burner—the "Metropolitan" argand burner No. 2—which is accepted by Parliament and the Board of Trade, and is, in fact, now almost compulsorily imposed upon gas undertakings seeking additional parliamentary powers.

Alderman Gibson showed his solicitude for the gas consumers by instructing me that the illuminating power of the gas should not be less than 17 candles, notwithstanding that 14 candles is now almost universally prescribed for all gas undertakings; and this power will be continued in Manchester until the next progressive step is made in the gas industry—viz., the general distribution of gas at high pressure at a price of 1s. to 1s. 6d. per 1000 cubic feet, which, in my judgment, is looming in the not distant future.

Leaving aside all questions of test-burners, and putting it into the simplest language, it is quite true that the gas supplied in Manchester at the present time will only give a light of 2 to 3 candles per cubic foot of gas used, against 3 to 4 candles per cubic foot in the case of the gas supplied ten to twenty years ago, when consumed in a flat-flame burner; but in practical use the difference between the two gases is not so great, owing to the flat-flame burners of to-day being constructed on more scientific principles than they were twenty years ago.

But why should we waste time in discussing the flat-flame burner, when, with the incandescent burner, for the same cost, including outlay on burners and mantles, four or five times the light can be obtained as compared with the flat-flame burner? With the existing pressure at which the gas is distributed, 20 candles of light per cubic foot can be obtained; and in the case of gas supplied at high pressure, a light of 60 candles per cubic foot of gas consumed is secured, as is demonstrated in the new installation of lighting round the site of the old Infirmary buildings in Piccadilly.

The obvious conclusion is, therefore, that, in their own interests, all gas consumers, even the poorest, should adopt incandescent gas-burners; and, as a matter of fact, the class of consumers referred to have seen the wisdom of this course, and have to a great extent abandoned flat-flame burners for the cheaper and better incandescent light.



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Though the gas in Manchester is regulated to 17 candles, our main guide is its calorific value, which we maintain at 600 B.Th.U. per cubic foot. The proportion of gas sold in Manchester is as follows :—

Ordinary consumers	76 per cent.
Automatic meter consumers	10 ,,
Gas-engines	7 ,,
Public lamps	7 ,,

These figures are quoted by Mr. Williams; but he does not state that at least 80 per cent. of the total gas used is dependent on calorific or heating power for its usefulness, and not on the illuminating power, as it is consumed in a bunsen form of burner for incandescent lighting, heating, cooking, motive power, and industrial purposes. There is no direct relationship between the calorific and illuminating powers of a gas; recent improved methods of carbonizing coal showing that gas of a comparatively low illuminating power can be produced having a high calorific value. There is thus only about 20 per cent. of the gas consumed in which illuminating power is of value; and this percentage is rapidly being reduced owing to the high cost of flat-flame lighting, however rich the gas may be. You cannot in fact dissociate consuming appliances from quality of gas when making a comparison with the gas supplied to-day and twenty years ago.

Mr. Norbury Williams points out that the price of gas in 1890 was 2s. 6d. per 1000 cubic feet, and the price of gas to-day is still 2s. 3d.; and he asks, in so many words, where has the saving gone by the reduction in the illuminating power? During the past twenty years, enormous burdens have been placed upon the department, and heavy concessions made to the gas consumers. The following particulars, taken from a statement prepared by Mr. F. P. Smith, the Accountant to the department, show the additional annual burdens borne by the gas undertaking in 1910, as compared with 1890 :—

Concessions.—Loss of Income :

1.—Reduction in price of gas	£57,600
2.—Abolition of meter-rents	18,700
3.—Abolition of stove-rents	17,000
Total	£93,300

Additional Burdens.—Increased Expenditure :

1.—Cost of eight-hour day for workmen, increase in pay, and workmen's compensation	£22,000
2.—Average provision for future renewals of plant (actual renewals only were charged in 1890)	15,000
3.—*Pro ratâ* increase of statutory sinking fund for redemption of loan capital consequent on large increase of "short life" plant	20,000
4.—Statutory obligation to meet out of revenue wages of Corporation workmen employed on capital account	6,500
Additional burden per annum in 1910 over 1890	£156,800

Then, again, in the year 1907, when the price of coal increased by 2s. 6d. per ton over the previous year, the price of gas was not temporarily raised—as was the case with some neighbouring gas undertakings—to the extent of 3d. per 1000 cubic feet, which in Manchester is equal to £66,000 per annum. As a matter of fact, with all these burdens thrown upon the Gas Department in recent years, it would be quite impossible to supply gas at the present price if great economies had not been effected in manufacturing costs, and the several works kept thoroughly up to date. In addition to this, the financial position of the Manchester gas undertaking has been placed on a sound footing, unsurpassed by that of any other corporation gas undertaking in the kingdom.

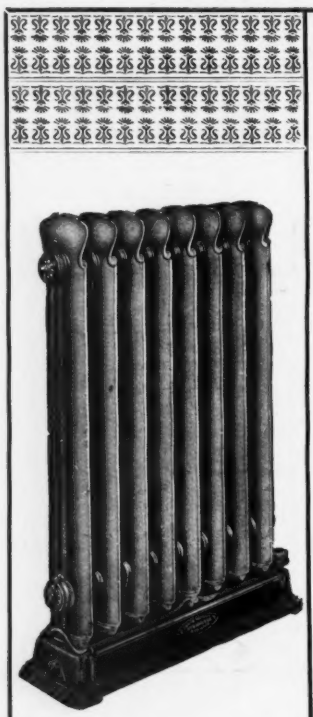
If Mr. Norbury Williams is anxious to safeguard the interests of the poorer citizens, let him support the Chairman in his endeavour to bring the price of gas down to an average of 2s. per 1000 cubic feet, which could at once be effected by relieving the Gas Department of the necessity to contribute £50,000 per annum in relief of the rates. This contribution of £50,000 per annum presses more heavily on the working class than on any other, and is, of course, a system of indirect taxation. The reduction of the price to 2s. per 1000 cubic feet would encourage the more general use of gas for purposes other than lighting; and in a short time the increased consumption which would inevitably follow this reduction would enable the Gas Committee to still further reduce the price. It is by taking up the subject of "cheap gas" that Mr. Norbury Williams would earn the gratitude of the citizens, rather than by discussing the economics of gas manufacture and supply, with which subject he is evidently not well acquainted.

I hope what I have said will influence Mr. Norbury Williams and other critics to help rather than hamper Alderman Gibson, the Chairman of the Gas Committee, who unselfishly devotes his time to the administration of a great undertaking with such signal success.

REDHILL AND REIGATE PUBLIC LIGHTING.

Dispute between the Reigate Corporation and the Redhill Gas Company.

The Reigate Town Council were engaged till midnight on Monday of last week debating a resolution which materially affected the Gas Company and their right to impose conditions on the Corporation where the question of renewing the contract for street lighting is concerned. The discussion, which came up in the form of a recommendation from the last Council meeting, was based on certain offers to pay the Reigate and Redhill Gas Companies £3 per lamp per annum for lighting public lamps, on the understanding that the number of lamps which might be converted to electricity should not exceed 10 per cent. of the number supplied to the 17th of August last, but that the Corporation should have the power to do so on payment of 10s. per lamp per annum during the three years' contract for every lamp so converted



A GOOD HABIT

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The Reigate Company accepted this offer; but the other Company declined to entertain it. They, however, consented to receive a deputation from the Council to discuss the matter. The deputation were unable to arrive at a satisfactory conclusion with the Company; and the Highways Committee recommended that it was advisable to put in force the statutory provisions of the Gas-Works Clauses Act, 1871, so as to secure a supply of gas for public lighting; and that on disagreement as to terms and prices, the Council should go to arbitration.

Mr. ONGLEY explained what took place at the meeting of the Directors of the Company and the deputation. He said the whole question was threshed out, and, with the exception of himself, the Committee agreed with the recommendation. It was most important to arrive at a decision at once, as the contract to light the public lamps expired on the 9th inst., and the Company could, if they so desired, plunge the public thoroughfares in darkness. They had accepted the Reigate Company's offer. The Redhill Company made a similar offer with regard to the charge to be made for lighting, but stated that if more than 10 per cent. of the lamps were converted to electricity, a sum of £3 should be paid for each lamp. It seemed to him this offer was a reasonable one. He did not believe the Corporation could grapple with the work themselves in time; and he strongly urged the Council not to adopt the recommendation of the Committee, but to accept the Redhill Company's offer.

Alderman BARNES expressed regret that things had come to a deadlock. Too much hostility had, he said, been shown against the Redhill Company because it was a gas company. They must remember that in the old days the Company had been essential to them, and had been always willing to pay attention to their requirements. They did not want to discard old friends; and personally he thought the Company's offer a very reasonable one, and one that ought to have been accepted. He laid stress upon the danger of precipitate action, and said before discarding the Gas Company they should ascertain what the Electric Lighting Company could do for them. The ratepayers deserved their first consideration. He should like to move the acceptance of the Redhill Company's terms, believing the Council would otherwise find themselves in "a confounded mess."

At this point, an opinion was expressed that the Mayor (Alderman Gregory) being a shareholder in the Redhill Gas Company, ought not to occupy the chair. Whereupon he vacated it, and it was taken by Alderman Barnes, who, in a long speech, urged the acceptance of the Company terms.

Other councillors having dealt with the question,

Mr. INCE said he had not heard any reasons advanced why the Committee's recommendation should be rejected. He denied that hostility had been shown towards the Gas Company by the Committee. They had tried to reason out the matter in a businesslike way. The Corporation had not, as a matter of fact, taken advantage of the powers of conversion which they might have done, and had converted fewer lamps to electricity than they were entitled to; but the moment they decided to vitalize their rights, the Gas Company said they should not do so. The Reigate Company had shown a very laudable desire to be friendly with the Corporation, but with the Redhill Company it was otherwise.

After a further two hours' debate, the Committee's recommendation was carried by a large majority; the Mayor and five other councillors, being shareholders in the Redhill Company, refraining from voting.

EDINBURGH AND LEITH GAS COMMISSIONERS.

The Edinburgh and Leith Gas Commissioners had before them, at their meeting on Monday last week, the following matters in addition to the report of Mr. W. R. Herring on the subject of the supply of cheap gas for trade purposes in the city and burgh noticed elsewhere.

DISCLOSURE OF PRICES.

Lord Provost BROWN (who presided) called attention to a part of the minutes of the Works Committee in which it was stated that "the Committee authorized the purchase of 250 tons of 'Lux' purifying material (at the price stated to the Committee) to be mixed with oxide of iron for gas-purifying purposes, the result of the experiments to be reported to the Commissioners;" and he asked if there was any reason why the price should not be stated. He thought this was a matter the Commissioners should very seriously consider. A great many observations were being made about their being obliged to put into their minutes the prices at which they bought things; and he would like the Commissioners to take the matter up, and, if possible, give a reason for their not doing this. He had it from various electors that too much was being kept back. There might be good reasons for this—he was not passing an opinion upon the matter; but he thought that if there were, they should be given in public.

Judge BRYSON (the Convener of the Committee) said there was a good reason. The material in question was a new one which they were testing; and they could not get it from the manufacturers unless they kept the price close.

The LORD PROVOST said this might be a good reason; but he thought it had better be considered.

TRADUCING THE COMMISSIONERS.

Provost SMITH, of Leith, said a question had been put to a town councillor at one of the ward meetings in Leith as to whether it was the fact that members of the Edinburgh and Leith Corporations got work done by the Water Trust and Gas Commissioners at cost price or less; and that workmen's time was not charged for. The questioner assured his hearers it was a fact which he could prove. This was a serious statement, reflecting on members of the Commission; and he thought it right to ask their officials whether or not it was correct.

Mr. HERRING stated that, so far as the Gas Commissioners were concerned, and also the members of the Edinburgh and Leith Corporations, they were treated in every way similar to any other of the gas

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consumers who came to them and asked them to do work for them. No favour whatever was shown to them.

Provost SMITH considered it only right, then, that the Law Agent of the Commissioners should be instructed to communicate with the gentleman referred to, and ask him to prove his statement or withdraw it.

This was agreed to.

ALLOWANCE TO DEPENDANTS.

The Finance and Law Committee reported that, in terms of a report by the Clerk (Mr. J. M'G. Jack) as to the powers of the Commissioners, they recommended that they could not grant a donation or allowance to Mrs. T. B. Henderson, the widow of a runner, or her children. In Mr. Jack's report, it was stated that several years ago the Commissioners granted special donations to the Edinburgh Royal Infirmary and the Leith Hospital, as an acknowledgment of the benefits conferred on their disabled employees by these institutions. The Commissioners' action, however, was challenged in Court, and it was held that the Commissioners were not entitled to grant the contributions, as these did not form expenses of managing and maintaining the undertaking; and the Royal Infirmary and the Leith Hospital repaid the donations. Section 8 of the Commissioners' Order of 1902 enlarged their powers. It authorized them to grant allowances "to aged and disabled employees, and to the dependants of any employees who may be serving with any of His Majesty's Forces in time of war or emergency." Section 30 of the Order of 1908 repealed the above section, but provided that "the Commissioners may, if they think fit, notwithstanding such repeal, continue thereafter, for such period as they may determine, to pay any such allowances under the said section so repealed which have been previously granted." The Superannuation Scheme under the Order of 1908 sanctioned superannuation allowances only to employees retiring after lengthened service, or on account of permanent infirmity of mind or body. On several occasions, the Commissioners have declined to grant allowances to widows and families of deceased employees, on the ground that there was no power to do this. But occasionally they had granted allowances, though they knew, when doing so, that they were exceeding their strict powers. These payments, however, were never challenged. The latest allowance they granted was on Nov. 30, 1908, of 7s. 6d. a week to the widow of the foreman at the Leith works. Objection was taken to this on the ground that making such a grant was *ultra vires*. Prior to the 1908 Order, the Commissioners' accounts were subject to objection at the instance only of a Commissioner of the Corporations of Edinburgh and Leith, or of any creditor holding a security on the undertaking. Since this Order, however, every ratepayer in Edinburgh or Leith, as well as every gas consumer, can also object. The recommendation was adopted.

Messrs. John Wright and Co. have received instructions to supply a suite of cooking apparatus for use in the Peers' Kitchen, at the Houses of Parliament, and a similar suite, including an instantaneous water-heater, for the Royal Scottish Academy's New Galleries, Edinburgh.

GAS FOR HEATING AND COOKING IN BELFAST.

Increased Consumption.

At a recent meeting of the Gas Committee of the Belfast County Borough Council, the Gas Engineer and Manager (Mr. J. D. Smith) reported that the number of heating and cooking appliances sent out by the Gas Department between Oct. 1, 1909, and Sept. 30, 1910, with the estimated consumption of gas in each case, was as follows: Cookers (1186), 43,289,000 cubic feet; fires (1285), 16,345,200 cubic feet; wash-boilers (32), 66,560 cubic feet; hot-plates and grillers (154), 554,000 cubic feet; circulating boilers (8), 49,920 cubic feet; laundry irons (121), 52,336 cubic feet; auto cookers (128), 1,868,000 cubic feet; auto boiling-rings (2060), 7,519,000 cubic feet; free boiling-rings (5534), 20,199,100 cubic feet—total, 89,942,316 cubic feet.

The report here referred to came before the Council in the minutes presented by the Gas Committee at the quarterly meeting last Tuesday. In the absence of the Chairman (Mr. J. A. Doran), owing to ill-health, Mr. Squire moved the adoption of the minutes. In doing so, he remarked that some 90 million cubic feet of gas had been consumed by the cookers and other appliances sold during the past twelve months. There were something like 870 million cubic feet of gas burnt by the cookers over the whole city, which was more than one-third of the total production of gas. This bore out what they had tried to impress upon the Council—viz., that it was not to the gas burnt for lighting that they looked for the great increase that would take place in connection with the necessities of the gas-works, but to the gas used by cookers.

PROPOSED SUPPLY OF CHEAP GAS FOR TRADE PURPOSES IN EDINBURGH.

Report by Mr. W. R. Herring.

At the Meeting of the Edinburgh and Leith Gas Commissioners on Monday last week—Lord Provost BROWN in the chair—the Works Committee submitted a report by Mr. W. R. Herring, the Engineer, as to the supply of cheap gas for trade purposes, which they had adopted. In the course of the report, Mr. Herring stated as follows.

The Commissioners having resolved to charge a special rate for gas used for trade purposes, other than for lighting, heating, and cooking, where such gas is used in approximately equal weekly quantities throughout the year, and principally during daylight hours, I have pleasure in intimating to you the following conditions under which this supply will be granted.

The supply must be by separate meter and fittings—the user either supplying his own meter under the usual conditions as to test, &c., or paying for the hire and fixing of such meter from the Commissioners,

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Gas Steam Radiator

is **complete** with reversible connection for gas supply. Gas-Air Adjuster to ensure perfect Flame with any quality Gas. Automatic Cut-Off Valve, when sufficient Heat is generated. Hinged Lighting Door, Base Plate, Removable Burner and every part Interchangeable Radiator with Radiator.

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and such alteration as may be required in the necessary piping to connect up the meter from the main supply. The user must provide a separate set of piping, exposed or otherwise, to the satisfaction of the Commissioners, leading from the meter to the apparatus in which the gas is to be used. The user must supply to the Commissioners a schedule of the apparatus proposed to be supplied with gas under the special rates; and such apparatus will have affixed thereto a seal bearing the Commissioners' mark. No additional apparatus is to be installed without first intimating to the Commissioners that such is the intention of the user; and this must be duly stamped before being put into use. Any infringement of these conditions will warrant the Commissioners in charging the current account at the lighting rate without notice to the consumer. The special rate will be applicable to such apparatus as the following:—

Gas-engines.	Blowpipes.	Laundry-irons.
Branding machines.	Brazing machines.	Enamelling-stoves.
Linotype machines.	Heating-irons.	Mufflers.
Laundry machines.	Soldering apparatus.	Drying-stoves.
Kilns.	Tailors' irons.	Gas-hammers.
Coffee roasters.	Upholsterers' irons.	Gas-blasts.

Also to such others as may be added to the list from time to time by the Commissioners. The rates to be charged for gas supplied under these conditions have been fixed at 2s. 3d. per 1000 cubic feet for the ensuing twelve months, for gas used within the boundary of the city of Edinburgh and burgh of Leith, and 2s. 9d. per 1000 cubic feet for gas used beyond such boundaries, both subject to the usual scale of discounts.

Applications for supply under these conditions will be dealt with in the order in which they are received, when an inspector will be sent to advise as to how the fittings are to be arranged; and after the fitting work has been executed, the inspector will again examine, and if found satisfactory, approve, of such, and attach the Commissioners' seal, after which the supply will be turned on. The Commissioners reserve all their rights under the Gas-Works Clauses Acts, the Sale of Gas Acts, &c., as to the terms and conditions of supply, so far as they are applicable to these special circumstances.

Attached is a schedule of the hire rates for meters, which also include the cost of the supply cock and connecting up when the new meter is fixed near the source of supply, but not otherwise. [The rates range from 3s. per annum for a 2-light up to 70s. for a 250-light meter.]

Judge BRYSON (the Convener of the Committee) expressed a desire to take the subject back for further consideration; and this was agreed to.

The Directors of the Continental Union Gas Company, Limited, have decided to recommend, at the forthcoming general meeting, dividends for the half year of 2 per cent. on the ordinary stock, free of income-tax, and 3½ per cent. on the preference stock, less income-tax; making 4 per cent. on the former and 7 per cent. on the latter for the year.

HASTINGS CORPORATION AND THE GAS-BURNER BILLS.

Complaint as to the Expense of Opposition.

The Corporation of Hastings were among the opponents of the Gas Companies (Standard Burner) Bills; and when the accounts for the opposition were presented at the meeting of the Town Council last Friday, the Town Clerk (Mr. B. F. Meadows) mentioned that he had received information that the Houses of Lords and Commons fees would be £11 11s. 6d. less than the amount stated in the accounts. Mr. E. C. Smith asked why another item of £215, which would also have to be paid, was not included in the accounts. Alderman Chesterfield said he had never seen a bill which he liked less than the one before them. Hastings had entered into the opposition to the Gas Bills with other towns in order to avoid many of the expenses which they had before them. This would be a warning to be more careful how they took part in joint opposition in future. They were informed that if they opposed jointly their costs would be much smaller than if they did so individually; but when they were scooped in, they had been let in for Parliamentary Agents' expenses which they did not expect to have to pay. If they had known things would be as they are, he ventured to say that Hastings would have opposed the Bills individually, and left the other places to go their own way. The Town Clerk had said that when he saw the accounts he was staggered by them. He (Alderman Chesterfield) was sure he had not the remotest idea that a twentieth part of the cost mentioned in the accounts was being incurred against the Corporation. Dr. Gray (the Chairman of the Hastings and St. Leonards Gas Company) said he could prove positively that Hastings was left alone at the last in opposition to the Bills. Before the House of Commons, only three towns appeared by Counsel—Hastings, Liverpool, and Torquay. Liverpool's case was taken separately; the opposition of Torquay was suspended; and this left Hastings alone. Dr. Gray read extracts from the shorthand notes to show that Counsel spoke on behalf of Hastings, and that the Town Clerk alone gave evidence against the Bill. Mr. Cox asked if it was not a fact that Hastings was merely taken as typical of all the other towns. The Town Clerk agreed that this was so. The accounts were then passed for payment, in due course, without any further discussion.

It may be of interest to give the constituent items in the accounts, as submitted by the Public Lighting Committee. They are as follows: Advertising, £1 5s. 10d.; Town Clerk's journeys to London and sundry disbursements, £9 5s. 5d.; Parliamentary Agents' charges, £101 4s. 4d.; Parliamentary Agents' disbursements—viz., printing petitions to the Houses of Lords and Commons, and copies, £11 6s.; Houses of Lords and Commons fees, £26; copies of printed proceedings before Committees of both Houses, and documents, £33 11s. 1d.; postages, telegrams, and incidental expenses, £2 9s. 7d.—total, £185 2s. 3d. These expenses are apart from the proportion of those incurred in connection with the joint opposition to the Bills.

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have found their way into the homes of the highest in the land and into buildings of magnificent as well as unpretentious appearance, but all are doing equally meritorious and efficient duty. There are thousands of "Monarchs" in daily use giving universal satisfaction. Every part is made by trained workmen, and every Radiator is guaranteed.
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GAS EXHIBITION AT CARLISLE.

In opening an exhibition of gas appliances at Carlisle, on Monday of last week, the Mayor remarked that it was only the duty of every citizen to do all he possibly could to assist the Gas Committee in continuing to improve the success which had at all times attended the city gas-works. Gas was first manufactured in Carlisle by a private Company; but the works in 1850 were purchased by the Corporation, at a cost of £18,000. The price paid was a good one; but he thought it was the wisest speculation that the Carlisle Corporation ever made. They had now had the works for sixty years; and the progress which had attended them had been simply marvellous, and the value of the undertaking had increased from £18,000 to £147,489. The sum standing against the works at the present time was £26,959. They saw, therefore, how favourably the gas-works stood from a strictly commercial point of view. All this had been accomplished in face of the fact that Carlisle charged a very low price for gas—only 2s. 3d. per 1000 cubic feet. This spoke volumes for the management of the concern. By the economical working of the gas undertaking, the citizens were paying less in rates than they otherwise would have had to do. During the last eight years, the average profit handed over to the City Treasurer was £5574; and this meant a rate of 4d. to 5d. in the pound. This was a splendid exhibition. Placed before them were the latest innovations in the gas engineering world; and they would derive much interest from examining them and getting their objects explained. He hoped no change would take place as to the manner of the disposal of the profits on the works in the future, and that they would continue to be handed over to the City Treasurer to keep down the rates of the city. No doubt the Committee, under the able management of Mr. J. P. Buck (the Chairman) would do their best to keep the works a profitable and popular concern; and they looked forward to the result of this exhibition being a further increase in the demand for gas for fires and the other appliances which were to be seen around them.

The exhibition, as stated by the Mayor, proved a highly interesting one; and a quantity of the most modern apparatus by the leading makers was included. The lighting was on the Keith high-pressure system. All the details were arranged and carried out by the Engineer, Mr. Harold E. Bloor.

Maltby Water Supply.—At the meeting of the Rotherham Rural District Council on Monday last week, a motion that the Sheffield water scheme, so far as Maltby is concerned, be deferred for a period of five years, to enable the Council to duly consider any other local scheme which in the meantime may be brought forward, and that the Clerks to the Council be instructed to withdraw application for the sanction of the Local Government Board to the Sheffield scheme, was negatived by ten votes to five.

METROPOLITAN WATER BOARD.

Humphrey Pump for Chingford—Afforestation Question.

At the Meeting of the Metropolitan Water Board last Friday, the Works and Stores Committee presented a report as to the provision of pumping machinery for the Chingford reservoir. They had received a report from the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) to the effect that it was necessary to provide for a total pumping capacity of not less than 180 million gallons in 24 hours, made up of one unit of 20 million and four units of 40 million gallons each. He had studied the various methods of raising large volumes of water to moderate heights, and in which only a comparatively low lift was required—viz., gas and oil engines, electricity, triple-expansion engines, and the Humphrey pump; and, having regard to his advice, the Committee recommended the installation of the pump just named by the Pump and Power Company, Limited. The cost of the installation of five pumps, inclusive of a Dowson gas-producer plant and all accessories, would be £19,388. The recommendation was discussed at some length; but it was eventually adopted.

Mr. Easton asked the Chairman of the Works and Stores Committee whether he could give any information as to what his Committee were doing with regard to the proposal to plant 100,000 trees upon the Board's waste land for afforestation. Mr. Hearson, in reply, said he believed a resolution had been passed that trees should be planted on certain conditions on some parts of the Board's land. It was not, however, desirable to plant everywhere; and it was in the hands of the Chief Engineer to bring up a report as to whether or not it would be desirable to plant the trees.

NOTTINGHAMSHIRE WATER FOR DERBYSHIRE.

Local Government Board Sanction a Scheme.

Some time ago, the Rural District Council of Clown, near Chesterfield, applied to the Local Government Board for power to borrow £41,500 for a joint scheme of water supply for the whole of their district; the source of the proposed supply being in Nottinghamshire. Owing to the fact that the recent report of the Select Committee on the Water Supplies (Protection) Bill was invoked by the opposition, the inquiry into the matter held by Mr. A. W. Brightmore, M.Inst.C.E., on behalf of the Board, assumed more than usual importance; and the result has been awaited with interest.

The Council have entered into an agreement with the Wigan Coa and Iron Company, Limited, to purchase in bulk by meter a supply of water, derived from the new red sandstone of Nottinghamshire, which

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Letter written to the

Bath Gas Light and Coke Company by the **Bath and District Rinks, Ltd.**

4th October, 1910.

I feel I must write and tell you I am very pleased with the lighting of this Rink, and have no hesitation in saying that I consider it one of the **best lighted Rinks in England.**

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was met with by the Company in sinking their shaft at Manton, near Worksop. The water is pumped to the surface by machinery fixed at the base of the sandstone in a well adjacent to the colliery shafts; and by the provision of a further set of machinery at the surface, the Company will deliver the water into a reservoir, from which it will gravitate to the eastern boundary of the Council's district, where it will be pumped again to a service reservoir and water-tower for distribution to the consumers—the total lift being 850 feet.

At the inquiry, it was urged, on behalf of the Nottinghamshire County Council, by Dr. Handford, the County Medical Officer of Health, that the question of the preservation of the water resources of the Nottinghamshire sandstone for use in the county had assumed the greatest importance, and that in considering the subject they had to look forward to a longer period than thirty years. Evidence was given of the remarkable recent increased population in the mining districts of Nottinghamshire; and it was stated to be now known that the present agricultural area would ultimately be covered by collieries, with their necessarily enlarged demands for water, while the supply derivable from the sandstone was a fixed and limited quantity. A copy of the report on the Water Supplies (Protection) Bill was put in, especially with reference to the appropriation of water for the benefit of other places, without regard to the needs of the locality from which it was taken, and to the proposed central authority for taking the necessary measures to husband the supplies and advise on their allocation. It was further urged that the particular question had been considered by Parliament in connection with the Worksop Water Bill, and that the Nottinghamshire County Council had obtained a clause prohibiting the sale of water beyond the boundary of the county without their consent.

On behalf of the Rural District Council, a large body of evidence was given as to the pollution and inadequacy of all the existing supplies, and as to the urgent need for an abundant supply of pure water for the colliery population, which was increasing with great rapidity. Evidence was given by the Council's Consulting Engineers (Messrs. G. & F. W. Hodson, of Loughborough) that no adequate source existed within their area; that, though a part of the district was entitled to demand water from the Derwent Valley Water Board, the cost would be prohibitive, and that the only available source was the Nottinghamshire sandstone; that Parliament had decided in the Worksop Bill that, so long as water was available from Manton, no further well ought to be sunk in the neighbourhood; that the county boundary, being an artificial one, was not such as was contemplated in the report; and that the needs of the district urgently requiring a supply ought to be considered before those of a problematical population.

The decision of the Local Government Board has now been made known; and their sanction to the loan has been granted.

Among the recent elections of members of the British Chamber of Commerce in Paris we notice there is included the name of Simon-Carvès, Limited, of Manchester.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At the meeting of the Scottish Junior Gas Association—Western District—in Glasgow to-night, Mr. G. Scott, of the Meter Repairing Department of the Glasgow Corporation, gave a plain and a detailed account of the procedure followed in the repair of meters. This is a work which the Corporation do for themselves, as is also the case in Paisley, and, to a greater or less extent, in one or two other towns. Mr. Scott's description of the work will not appeal to a wide circle of readers; but there doubtless are many gas managers in small works who like to do a little tinkering themselves at apparatus under their charge, and to them the paper will be of assistance. There was a spirited discussion, which was confined to the ordinary members—not to any degree upon the repair of meters, but rather upon the use of meters generally, and the latest developments in the world of meters—in which a number of interesting things were said.

The monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday was noteworthy for two items of business, neither of which was technical, but both of which were of importance. In the one instance, Lord Provost Brown stated, somewhat abruptly, his view that something was being held back in the non-communication to the public of the prices at which commodities are bought. The subject was sent to the Works Committee for inquiry. The inquiry can only result in one of two ways. Either the Commissioners may resolve to give the price of every article that is contracted for, which would be absurd and unbusinesslike, or they may go on as they have been doing, and withhold that which, in their opinion, should be withheld, which would be the common-sense way of doing business. The other matter referred to was the remark, looked upon as slanderous, made by an elector in Leith regarding the privileges of town councillors. The subject has gone into the hands of the Law Agent to the Commissioners. It is right of the Commissioners to be chary of their honour. At election times much has to be endured; but this instance is looked upon as more offensive than the ordinary badinage which is often indulged in, in respect of the positive nature of the assertion and of the relationship of the speaker to a gentleman who is a member of the Leith Town Council.

The municipal elections which have been concluded this week have not been of much interest; neither have they produced much change in the outward appearance of public life. In Glasgow, I note that Bailie Paxton, taking the place of Mr. M. W. Montgomery, has been appointed Convener of the Gas Committee, and Bailie Kirkland takes Bailie Paxton's place as Sub-Convener. In Arbroath, Bailie Smith has been re-elected Convener of the Gas Committee—a position which he has held since 1906. In Falkirk, Bailie Bogle, who has been Gas Convener since 1906, has been elected Provost of the burgh, and Councillor Muirhead has received the appointment of Convener of the Gas Committee. The most important public question involved in any

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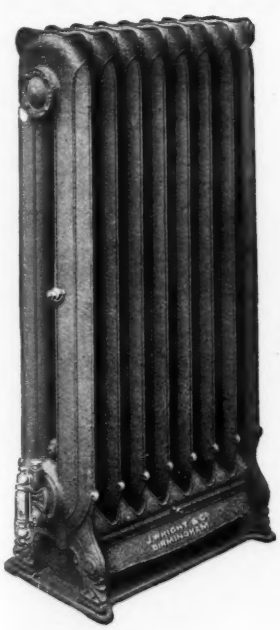

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Steam Principle.

Only by means of this principle can—

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YOU ARE SAFE WITH THE PIONEERS.

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Essex Works, BIRMINGHAM.

257.

of the municipalities of Scotland has been that of the water supply to the city of Aberdeen. A few months ago, the Corporation promoted a Bill in Parliament for the taking of water from the River Avon. The Bill was rejected, and since then there has been continued agitation locally as to the desirability of making further effort to seek a new water supply in the Avon, or to augment the existing supply from the River Dee. There were contested elections on Tuesday in five of the eleven city wards; and the result was that, in every instance, the advocates of the Dee extension proposals were returned by large majorities. Lord Provost Wilson heads the Avon party, which now counts 13 in the Town Council, as against 21 for the Dee party.

Last night, the first of a course of lectures under the auspices of the Smoke Abatement League was delivered in the Technical College, Glasgow, by Professor Glaister, of Glasgow University. The Professor dealt with the subject of "The City Atmosphere and the City Health." Last night, also, there was a meeting of the Company of Honourable Alchymists, in the botanical lecture-room of the Glasgow University, at which Principal Sir Donald M'Alister presided, and a lecture on "Air Pollution" was given by Professor J. B. Cohen, of the University of Leeds. Professor Cohen said the smoke problem divided itself into three distinct parts—the cause, the effect, and the remedy. The cause was easily explained. It was mainly a chemical question on which he did not propose to enter. The suggested remedies were manifold. They were partly chemical—such as the substitution for coal of combustible gas, coke, anthracite, or coalite—and partly mechanical, as illustrated by the use of mechanical stokers, forced draught, and other appliances. There was no doubt that the use of gas for heating was gradually gaining ground among the more enterprising manufacturing firms; but nothing but outside pressure, steadily and firmly applied, would induce the great bulk of coal users to make a change.

On the occasion of the turning on of the gas to a new gasholder at Buckie on the 31st ult., ex-Provost Webster, Vice-Chairman of the Buckie Gas Company, Limited, who performed the ceremony, said that during the past year the gas-works had been practically reconstructed. The retort-house had been rebuilt, and a setting of retorts of the most up-to-date style put in. It was found that their storage capacity was too small, and a new gasholder, of 54,000 cubic feet capacity, had been built. Forty-one years ago, the first holder was erected, and it met the requirements of the Company for 17 years. Then a second holder was installed; but it was now too small. The price of gas was then 12s. 6d. per 1000 cubic feet; but they had been reducing it until it now stood at a little over 5s. per 1000 cubic feet. He considered that it would be some time before another reduction would take place, as a large capital outlay had been incurred during the year. Alterations had been made on the condensers, the purifiers had been almost renewed, and an exhauster had been installed, which would mean better results. The successful termination of the various contracts was due to a large extent to the capabilities of Mr. S. Milne, of Aberdeen, the Engineer. The Contractors for the new holder were Messrs. Clayton, Son, and Co., Limited, of Leeds.

In the Sanquhar Town Council last week, a letter from Messrs. Firth Blakeley and Co. was read, in which it was asked that they be relieved from the liability of counterbalancing a telescoped gasholder. The Town Clerk explained that the firm had undertaken to put the gasholder in proper order, and a sum of £53 of the contract price was still kept up until the work should be completed; but they now wanted to be relieved of their contract altogether. If the Council would do this, they were prepared to put in a new engine and exhauster, to assist in counterbalancing the pressure, for a sum of £60 and the old exhauster. He held that this new plant was worth £110, and that the value of the old exhauster was £10; and thus the Council were getting £40 off the first contract. The Council resolved to consult Mr. W. Fairweather, of Kilmarnock, upon the matter.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 5.

Sulphate of Ammonia.

Although the tone has been quieter during the past week, there has not been much actual decline in values; but in some instances purchases have been made at 1s. 3d. per ton less money. Buying for covering old contracts has to a certain extent been suspended meantime; but the new orders which have come on the market have been sufficient to absorb all parcels offered. The quotations at the close are £12 18s. 9d. to £13 per ton f.o.b. Hull, £13 to £13 1s. 3d. per ton f.o.b. Liverpool, and £13 1s. 3d. to £13 2s. 6d. per ton f.o.b. Leith. No further sales by manufacturers have been recorded for future delivery; but it is stated that second-hand sellers are offering for shipment January-June, 1911, at 2s. 6d. to 5s. per ton below prompt prices.

Nitrate of Soda.

The spot values of this article are still unchanged at 9s. 4½d. per cwt. for ordinary and 9s. 7½d. for refined quality, the market continuing quietly steady thereat.

LONDON, *Nov.* 7.

Tar Products.

The markets for tar products have remained fairly steady throughout the past week. Pitch continues in about the same position, though reports from the Continent state that this article is being offered there for delivery between now and April 1 next at considerably under the equivalent of the market price here. In creosote, the market is not very active, but there does not appear to have been any further weakening in prices. In benzol, 90 per cent., the market remains in about the same position; but no substantial transactions are reported to maintain the recent improvement. Fifty's show a little dull; but the price keeps fairly firm. Crude carbolic continues in about the same position. Solvent naphtha is quiet; heavy naphtha is fairly steady; and in some quarters slightly better prices have been obtained.

The average values during the week were: Tar, 17s. 3d. to 20s. 9d. *ex*

R. & J. DEMPSTER, LIMITED,

Leading Makers of SPIRAL GUIDED GASHOLDERS.

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Spiral Plates
Steel Tested
Special Rails
Smooth Rollers
Steady Action
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Save Capital
Safe and Sure
Stand Severe
Snow Storms and
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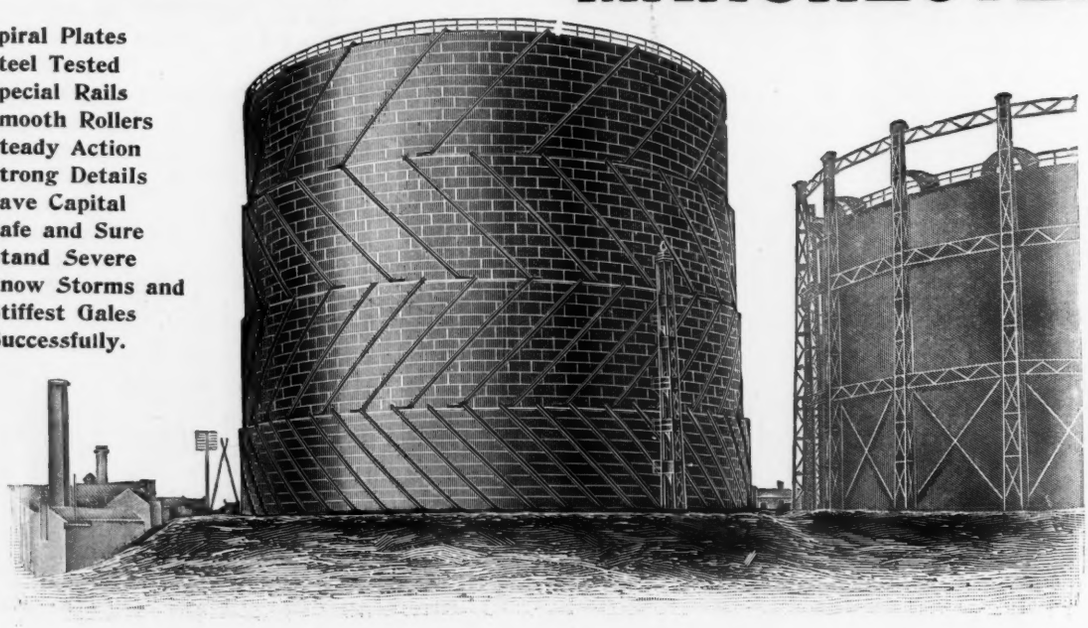


From a Photograph showing the conversion of a Two-Lift Guide Framed Holder to a Four-Lift Spiral Holder of 3½ million cubic feet capacity, for the Newcastle and Gateshead Gas Company, to Plans and Specifications of W. D. GIBB, Esq., M.Inst.C.E., Engineer.

works. Pitch, London, 34s. to 34s. 6d.; east coast, 33s. 6d. to 34s.; west coast, 37s. to 38s. 6d. Clyde ports, 32s. 6d. to 33s. Manchester, 33s. 6d. to 34s. Liverpool. Benzol, 90 per cent., casks included, London, 7½d. to 7⅝d.; North, 7½d. to 7⅝d.; 50-90 per cent., casks included, London, 7⅝d. to 8d.; North, 7½d. to 7⅝d. Toluol, casks included, London, 9d. to 9⅛d.; North, 9d. Crude naphtha, in bulk, London, 3⅞d. to 4d.; North, 3½d. to 3¾d.; solvent naphtha, casks included, London, 11⅛d. to 1s. 0⅛d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11¼d. to 1s.; North, 10½d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅝d. to 2¼d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market remains steady, though the volume of new business has not been quite so large. Actual Beckton can be purchased at £12 10s.; outside London makes, at £12 8s. 9d.; and Hull, at £13 1s. 3d. to £13 2s. 6d. In Liverpool, the quotation is £13 2s. 6d. to £13 3s. 9d.; and in Leith, £13 3s. 9d. to £13 5s.

Owing to a clerical error, the price of Beckton sulphate in last week's report was given as £11 2s. 6d. instead of £12 12s. 6d.

TAR PRODUCTS.

Representative manufacturers give the following as fair current values for the week ending Nov. 5.

Article.	Basis.	Lond'n.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	ton	21s.	19s.-11s.	20s.-22s.	19s.-21s.	19s.-21s.	—
Pitch	,,	36s.-37s.	23s.	33s.-33s.6d	36s.	35s.-36s.	37s.
Benzol, 90%	gal.	8¼d.	7d.	8d.	7⅜d.-8d	7⅜d.-8d.	7⅜d.
Benzol, 50/90%	,,	9d	8d.	9d.	8d.-8¼d.	8d.-8¼d.	—
Toluol, 90%	,,	—	9d.	10d.	10d.	10d.	—
Crude naphtha, 30%	,,	—	3¼d.	3¼d.	3¼d.	3¼d.	—
Light oil, 50%	,,	—	3d.	3⅛d.-3¼d.	3d.	3d.	—
Solvent naphtha, 90/160	,,	—	10½d.	10½d.	1s. 1d.	1s. 1d.	1s.
Heavy naphtha, 90/190	,,	—	11d.	11d.	1s.	1s.	1s.
Creosote in bulk	,,	2⅜d.	2¼d.	2d.	2¼d.	2⅛d.-2¼d	2d.
Heavy oils	,,	3d.-3⅛d.	2⅛d.	2⅛d.	3d.	3d.	—
Carbolic acid, 60's	,,	1s. 0⅛d.	11⅛d.-11⅜d.	1s. 0⅛d.	1s. 0⅛d.	1s. 0⅛d.	1s. 1d.
Naphthalene, crude drained salts	ton	—	37s. 6d.	40s.-42s.6d.	50s.	50s.	—
Do., pressed	,,	—	50s.	63s.	60s.	60s.	—
Do., whizzed	,,	80s.	—	—	75s.	75s.	65s.
Anthracene	unit	2d.	1¼d.	1¼d.	1¼d.	1¼d.	—

Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

COAL TRADE REPORTS.

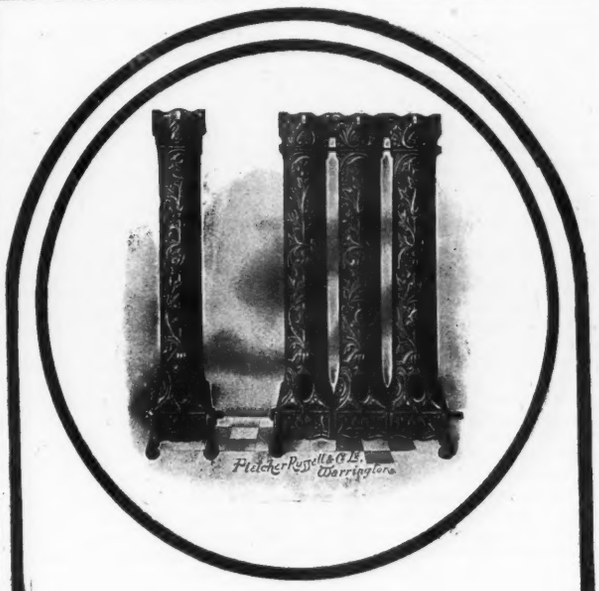
Northern Coal Trade.

The coal trade has been irregular, and prices have stiffened through the effect of the uncertainty as to working in South Wales. In the local steam coal trade, best Northumbrians are from 9s. 9d. to 10s. per ton f.o.b.; but the values move rather rapidly. Second-class steams are from 8s. 6d. to 8s. 9d. per ton, and steam smalls are about 5s. 6d. to 6s. 6d. There is a steady output at most of the collieries, and it is well taken up generally. In the gas coal trade, the demand steadily improves; while the deliveries on the long contracts are now very heavy, and take up much of the production of the best-known collieries. Durham gas coals vary in price according to quality. The usual classes are from 8s. 9d. to 9s. 7½d. per ton f.o.b.; while for "Wear" specials, 10s. 4½d. is quoted. One or two contracts have been placed, but not for very large quantities. There are also offers for coal for some of the Italian ports, but at prices which are not acceptable to the sellers. The lack of ready steamers is impeding the gas coal trade. It has forced up the rate of freights, and thus makes the coal dearer at the ports of delivery. It has also hindered the shipments on contract; and there is as yet not much prospect of early full supplies. In coke, the demand is fair; and the fuller production of gas coke seems to be well taken up. Good gas coke is firm at about 14s. per ton f.o.b.

Scotch Coal Trade.

Trade has deteriorated. There has been no improvement in the home demand, and the foreign inquiry has gone back somewhat. There is much indecision, on account of trade troubles, in consequence of which the market is meantime greatly weakened. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 310,350 tons—a decrease of 25,074 tons upon the previous week, but an increase of 13,170 tons upon the corresponding week last year. For the year to date, the total shipments have been 13,432,446 tons—an increase upon the corresponding period of 710,244 tons.

Encouragement of Cooking by Gas.—With the view of encouraging the use of gas-stoves for culinary purposes in the household, the Cardiff Gas Company offered medals and certificates to scholars in the elementary schools of the borough for the best assays on the "Use of a Gas-Cooker." About 300 girls entered for the competition; and six silver and a like number of bronze medals have been awarded.



GAS RADIATORS

THAT

DO NOT

Give off Smell.
Get out of order.
Require Automatic Valves.
Get furred up.

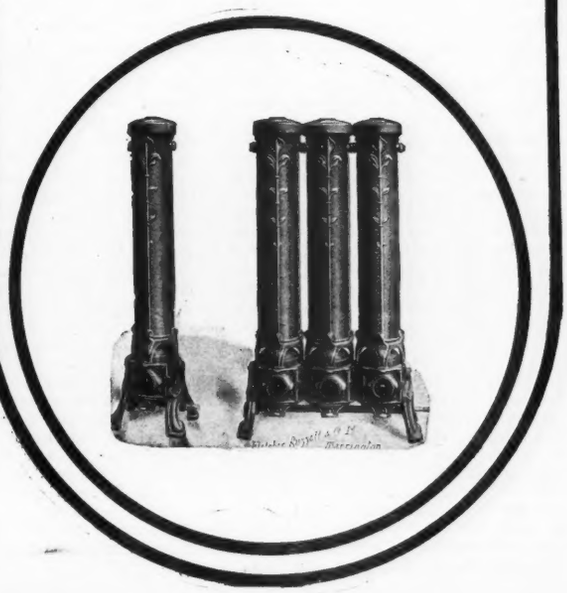
BUT

DO

Commence useful work immediately.
Heat up rapidly.
Heat economically and effectively.

LOW PRICE & CHEAP MAINTENANCE.

FLETCHER, RUSSELL,
& CO., LTD.,
WARRINGTON.



Gas Lighting in Japan.—The report of the British Consul on Kobe (Japan) furnishes the information that a new gas company has been formed for the purpose of supplying gas to the city of Sakai. The capital of the Company is 600,000 yen (£61,250), of which the Osaka Gas Company (65 per cent. of the capital of which is American) is to hold 51 per cent.—thus securing a preponderating interest. The gas is to be supplied by means of a main laid from the Osaka works. The Osaka Gas Company is the only one left in the city in which foreign and Japanese interests are jointly concerned; and the undertaking continues to be prosperous. The net profit for the second half of 1909 was upwards of £25,000. A dividend of 9 per cent. was declared.

Trial of Improved Gas Lighting in Fulham.—The Lighting Committee of the Fulham Borough Council report that in June last authority was given to the Gaslight and Coke Company to substitute inverted for upright incandescent burners in six of the public lamps at Parson's Green, to demonstrate their contention that improved efficiency and economy would be obtained by the alteration; and it was proposed, subject to the experiment proving satisfactory, to lay a scheme before the Council for the conversion of the whole of the remaining gas-lamps in the borough upon reasonable terms. Having inspected the new burners, the Lighting Committee are of opinion that there is not sufficient improvement in the lighting to justify the expense of altering all the remaining lamps in a similar manner; and they have instructed the Town Clerk to inform the Gas Company to this effect.

Weston-Super-Mare Water Supply.—A Committee meeting of the Weston-super-Mare Urban District Council was held last Tuesday for the purpose of receiving a report presented by the Water Supply Committee in reference to a proposed application for powers to provide additional water storage accommodation. The Committee recommended that application should be made to the Local Government Board for a Provisional Order amending the local Improvement Act of 1887 so as to provide for the construction of a reservoir at the north-east corner of the water-works estate, on a site abutting the existing structure in the Bristol Road, or adjoining the present reservoir. An open meeting of the Council was subsequently held, at which it was explained that the local water supply was absolutely unlimited, and that the extra storage accommodation would be provided merely in view of the rapidly-increasing population. The recommendation of the Committee was confirmed unanimously.

Leigh (Lancs.) Gas-Works and the Rates.—The Leigh (Lancs.) Town Council have applied to the Local Government Board for sanction to borrow £7700 for gas purposes; the money being required for mains, services, and meters. At an inquiry held recently by Mr. H. R. Hooper, it was elicited that the Gas Department had no reserve fund, and that, in addition to the amounts given in aid of the rates out of profits, gas had been supplied free for street lighting to the estimated value of £22,000 before it was charged in the rates to the Highways Department. Since the undertaking was purchased by the Local Authority in 1874, loans had been sanctioned to the total of £175,003; and the capital expenditure up to March last was £168,780. The Inspector, at the close of the inquiry, said he thought it would be well if the Gas Department set about building up a reserve fund, and not give the profits on the undertaking for a reduction in the rates as formerly.

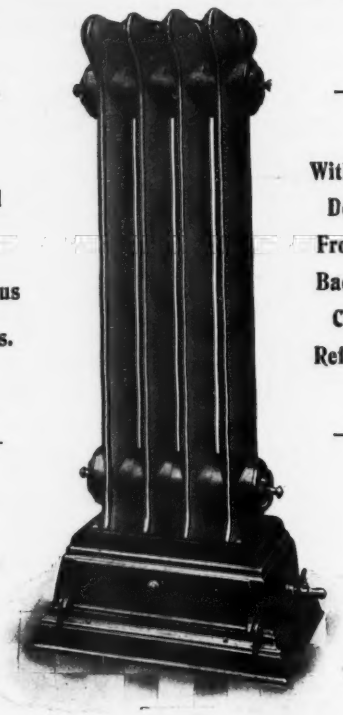
Abstraction of "Excess" Water from the Thames.—At the meeting of the Thames Conservancy on Monday last week, the subject of the drawing of "excess" water from the Thames by the Metropolitan Water Board was under discussion. The Clerk to the Board (Mr. A. B. Pilling) wrote that he had had under consideration the accounts rendered by the Conservancy in respect of the abstraction of "excess" water from the Thames during the half year ended June 30. He regretted that he could not advise the Board to entertain the claim; and he suggested that the accounts should remain in abeyance, without prejudice to the rights of either party, pending the settlement of the questions now at issue between the Board and the Conservancy. The Secretary to the Conservancy (Mr. F. W. Geary) replied on the 24th ult. that he could not advise his Board to allow the payments due for excess water to remain in abeyance as suggested, and requested that the Clerk would be so good as to forward a cheque for the amount due (£622) without further delay. The matter was discussed in private; the Chairman (Lord Desborough) making a statement with regard to the present position of the negotiations between the Conservators and the Board; and consideration was given to the question of promoting a Bill in Parliament in the ensuing session to deal with the matter.

End of the Torquay Water-Works Farming Experiment.—It was decided by the Torquay Town Council yesterday week to discontinue the farming operations which have been carried on by the Water Committee on a portion of the watershed on Dartmoor. Some years ago, the Corporation purchased the whole of the land constituting the watershed with the idea of ensuring the water against any possible risk of contamination from the farms which then existed. In order to make use of the land, and in the hope of recovering part of the heavy outlay, the Committee decided to carry on farming under conditions which would entail no danger of the water becoming impure. Their operations have been subjected to considerable criticism from time to time; and at last week's meeting of the Council, Mr. Taylor, the Chairman of the Committee, had to admit that, from the financial point of view, they have not been a success. He said that in 1900 they had an indebtedness of £724, and it had increased this year to £2875, against which, however, they had stock of the value of £2870. In his opinion, the indifferent results were principally due to want of capital, and the consequent limitation of the quantity of stock. Mr. Glanfield and Mr. Pike severely criticized the operations of the Committee, and contended that thousands of pounds had been lost through the municipal farming operations during the last ten years. Alderman Winter said the important question was that of the maintenance of the purity of the water. The watershed was purchased with this object, and the farming had been a subsidiary thing. What was to be done in future to keep the land in a pure and sweet condition? Mr. Taylor promised that the Water Committee would bring up a scheme for dealing with the land; and with this understanding, it was decided that the farming operations should be brought to an end as soon as might be found convenient for the disposal of the stock.

The CANNON

"TORRID"

Gas Heated Radiator.



Fitted with Luminous Burners.

With Trivet Door at Front and Back, and Copper Reflectors.

Pure Heated Air.

FACTS as proved by Scientific Test:—

NO FLAME CONTACT WITH COLD SURFACES, securing Perfect Combustion.
NO FUMES—NO FLUE REQUIRED.
NO EXPOSURE OF FLAME.
NO CONDENSATION IN TUBES, and therefore
NO CORROSION OF TUBES.

Ask for our "Congenial Warmth" Booklet, containing full report of this Test, carried out by a well-known Gas Engineer.

Manufacturers:—

CANNON IRON FOUNDRIES, LD.,

DEEPFIELDS, Nr. Bilston, Staffs., Eng.

London Showrooms:—

18, HOLBORN VIADUCT, E.C.

Australasian Agents:—

JAMES HURLL & CO., Ltd., 20, Loftus St., SYDNEY.

Gas Supersedes Oil in Dutch Guiana.—According to the annual consular report on Surinam (Dutch Guiana), during the past year the old oil-lamps by which in the past the town of Paramaribo had been lighted gave place to gas-lamps. The new lighting, though a great improvement on the former state of things, is not altogether satisfactory. The Gas Company are the only importers of coal for sale; the stock being kept up to 4000 tons of Welsh steam coal.

Retford Gas and Water Supply.—The gross profit of the Retford Corporation in connection with their gas undertaking for the past financial year was £2113, compared with £2287 for the preceding twelve months; while the net profit is £697 against £942. The water-rates amounted to £2993, compared with £2936. This is considered satisfactory, having regard to the slackness in the building and other trades and the large number of empty houses. The amount standing to the credit of the profit and loss account is £753.

Salford Corporation and Slot-Meter Consumers.—The *agenda* for the monthly meeting of the Salford Town Council includes two notices of motion in the names of Messrs. Bescoby and Johnson, whose object it is to secure a rescinding of the resolution of the Council passed in June last which reduced the quantity of gas supplied for a penny to consumers using automatic meters from 30 to 27 cubic feet. Mr. Johnson also asks that the reduction in charges to large consumers agreed to at the June meeting of the Council be rescinded likewise.

Ventilation of Street Boxes.—The Town Clerk of Woolwich has issued a circular-letter to the other Metropolitan Borough Councils, stating that the Woolwich Council are of opinion that, having regard to the fact that explosions have taken place owing to the escape of gas into street boxes constructed by the Post Office, telephone and electric lighting companies, and other similar authorities, these boxes should be ventilated, so as to prevent the possibility of such explosions. In order to ensure a uniform system of ventilation, the Woolwich Council have addressed a communication to the London County Council, asking them to consider the advisability of framing regulations so as to secure ventilation. It is intended that the regulations should apply to the whole County of London, and be enforced by the various local authorities, who are asked to support the action taken in the matter.

Damage to a Gas-Meter by a Precocious Girl.—At the Tottenham Children's Court last Tuesday, a girl named Marie Carroll (14), residing with her parents at 26, Dunbar Road, Wood Green, was charged with damaging a prepayment gas-meter, the property of the Tottenham and Edmonton Gas Company, in her house, and stealing 6s. 4d. from it. According to the evidence, the girl told an extraordinary story about being attacked by burglars, and having her hands tied while they broke open and emptied the money-box of the meter. This turned out to be an entire fabrication, the result of the girl having seen such an incident depicted at a cinematograph theatre. When asked by a detective to give particulars of the burglars, she admitted that she had broken open the meter, and spent some of the money. The prisoner's father said she was a very good girl, and was a great help to her mother. The Bench bound her over with her father in a sum of 40s. each to be of good behaviour for six months. The Chairman remarked that they had been in doubt as to whether they ought not to inflict a fine, and charge it to the father, for having allowed the child's innocent mind to be influenced by these pictures.

In view of the fact that gas managers will soon be thinking about the extra demands for gas which will be made upon them at the time of the Coronation next year, their attention may be directed to the latest catalogue (No. 157) of Messrs. D. Hulett and Co., Limited, of High Holborn, W.C., a special feature of which is a collection of devices suitable for that occasion. They occupy eight pages, and include various transparencies, printed in colours, suitable for gas. The rest of the catalogue, which extends to about 140 large pages, consists of upright and inverted burners, lamps, brackets, pendants, lamp-columns, mantles and globes, gas stoves and radiators, &c.

APPLICATIONS FOR LETTERS PATENT.

24,622.—Barker, W. H., jun., "Conveyors for coal." Oct. 24.
24,684.—Fleischer, E., "Gas-producers." Oct. 24.
24,698.—Archer, D. J., "Gas-heaters for irons." Oct. 24.
24,754.—Cross, F. L., "Regulator for gas." Oct. 25.
24,793.—Woodworth, L., "Gas-engines." Oct. 25.
24,794.—Woodworth, L., "Internal combustion engines." Oct. 25.
24,863.—Marks, E. C. R., "Valves and taps." A communication from J. A. Barbour. Oct. 26.
24,903.—Davis, H. N., and Twigg, W. R., "Gas-fires." Oct. 26.
24,904.—Davis, H. N., and Twigg, W. R., "Fuel for gas-fires." Oct. 26.
24,948.—Grieve, G. K., and Peebles, W. C., "Gas-governor." Oct. 27.
24,973.—Ehrich and Graetz, "Incandescent lamps." Oct. 27.
25,001.—Hume, G. W., "Pipe-joints." Oct. 27.
25,009.—Schroeder, F. W., Penny, W. J., and Gibson, E. J., "Delivery or supply pipes." Oct. 27.
25,049.—Thorp, T., F., & H. T., "Apparatus for the combustion of a mixture of gas and air in enclosed spaces." Oct. 28.
25,066.—Pace, P. C., "Manufacture of air gas." Oct. 28.
25,085.—Kenyon, T., "Testing water-pipes." Oct. 28.
25,093.—Berry, J., Glover, W. T., and Meters Ltd., "Gas-meters." Oct. 28.
25,103.—Morrison, E. J., "Controlling valves or the like at predetermined times." Oct. 28.
25,128.—Corbett, J. J., "Gas-regulator." Oct. 29.
25,141.—Bennis, E., "Discharging coal from waggons." Oct. 29.
25,172.—Glover, A. W., and George Glover and Co., Ltd., "Coin-controlled mechanism for governing the supply of gas." Oct. 29.
25,177.—Fowler, R., and Meters Ltd., "Gas-meters." Oct. 29.
25,178.—Richey, W. F. A., and Stobart, H. J. S., "Light concentrating appliances for use with gas-fittings." Oct. 29.

The "AGATE."

PARKINSON FIRES
are unsurpassed for
Heating Efficiency and Economy in Gas Consumption.
All Wearing Parts Strictly Interchangeable.
HIRED OUT BY MANY GAS UNDERTAKINGS.

The "BASIL."

May we send you a Sample for inspection?
THE PARKINSON STOVE CO., LD.
(Incorporating MAUGHANS' PATENT GEYSER CO.)
BIRMINGHAM & LONDON.

The "CRYSTAL."

During a short, sharp thunderstorm which occurred at Newcastle-under-Lyme last Tuesday evening, the Waterloo Chemical Works of Messrs. C. Massey and Son were struck by lightning. One effect was to fuse an electric wire in the office and burst a gas-pipe in the wall immediately behind it, setting the place on fire. By means of a patent fire extinguisher the flames were quickly put out; and with the gas turned off and the dynamo stopped, any danger there might have been was soon over.

During a storm which swept over the Manchester district on Monday night of last week, a marquee erected at the corner of Ashfield Road and Tatton Road, Sale, containing a collection of gas stoves and gas appliances, was blown down and damage caused to the stock to the extent of about £100. The exhibits in the marquee had been got together under the direction of the Stretford Gas Company to demonstrate the usefulness of gas for lighting, cooking, and heating; the firms represented at the exhibition including Messrs. Fletcher, Russell, and Co., Messrs. John Wright and Co., the Parkinson Stove Company, Messrs. Wilsons and Mathiesons, Messrs. Makenson, Bowen, and Co., and the Davis Gas-Stove Company. Measures were at once taken to repair the damage. The marquee was re-erected, and the exhibition continued over Saturday. The Stretford Gas Company had a stall at the exhibition.

The Foster Engineering Company, Limited, of Morden Road, Wimbledon, S.W., send a copy of their most recent list of the Foster gas-governors. They are making two types, either of which can be used for all pressures up to 27 inches. Pressure charts have been taken by an independent authority on two governors—the Foster Standard Duplex and one of another make; and we are informed that, whereas the line given by the Foster was perfectly straight, the charts taken on the other one showed the pressure varying between wide limits.

Mr. M. D. Propert, the District Auditor for the Local Government Board, in his report on the accounts of the Pontypridd Urban District Council for the year ended March 31, 1909, states that considerable expansion is shown in the volume of the financial transactions of the Council as compared with the preceding accounts. The results on the year's trading in the gas-works, tramways, and electricity works disclosed a deficit in each case; and it was necessary for him to press that these accumulating deficits should be met and dealt with by the Council in accordance with statutory provisions. The financial results were laid before the Council promptly and very clearly by their Accountant (Mr. L. R. Williams) year by year; and it was essential that the demands which were placed before the Council in the estimate half yearly should be provided for, if it was desired to establish the trading concerns on a commercial basis. The alternatives were fairly obvious.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

FOREMAN OF WORKS. No. 5311.
REPRESENTATIVE (GAS-STOVES). No. 5312.
STOKER. Pontardulais Gas-Works.

Situation Wanted.

GENERAL MANAGER (GAS FITTING, &c., TRADE). T. L. Cuttell, Stockton-on-Tees.

Patents for Disposal, &c.

AUTOMATIC PRESSURE CHANGER. 46, High Street, Witney, Oxon.
INCANDESCENT MANTLE. Dr. Walter, Canonbury.

Lectures, &c.

DISTRIBUTION AND USES OF COAL GAS, AND BYE PRODUCT COKING PROCESSES. Leeds University. Particulars of Registrar.

Stocks and Shares.

PINNER GAS COMPANY (BY AUCTION). Nov. 22.

TENDERS FOR

Gasholders, &c.

DUDLEY GASLIGHT COMPANY. Tenders by Nov. 21.

Tar and Liquor.

TAMWORTH GAS COMPANY. Tenders by Nov. 12.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 5s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
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LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

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SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
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GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2886 HOLBORN.

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PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
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J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
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REPAIRS RECEIVE PROMPT ATTENTION.
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Telegrams:—
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ANY QUANTITY. ANY PORT. ANY STATION.
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DUTCH OXIDE OF IRON.
SPENT OXIDE PURCHASED IN ANY DISTRICT.
THE First Dutch Bogore Co., Ltd.,
NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, SUTTON, SURREY.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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The Directors do not bind themselves to accept the lowest or any Tender.

T. E. Stillard,
Secretary.

Gas-Offices, Gas-Works,
Dudley, Oct. 26, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
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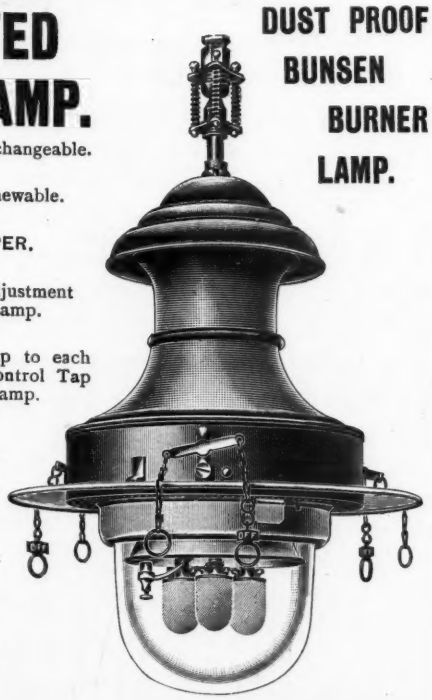

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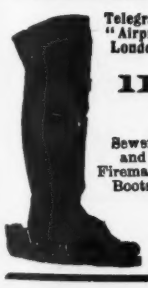

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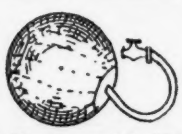

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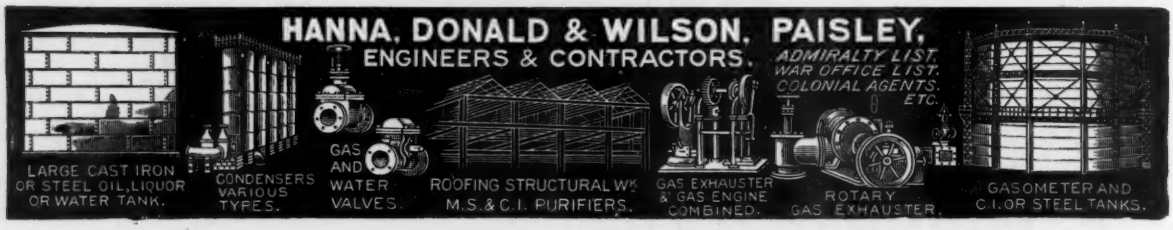
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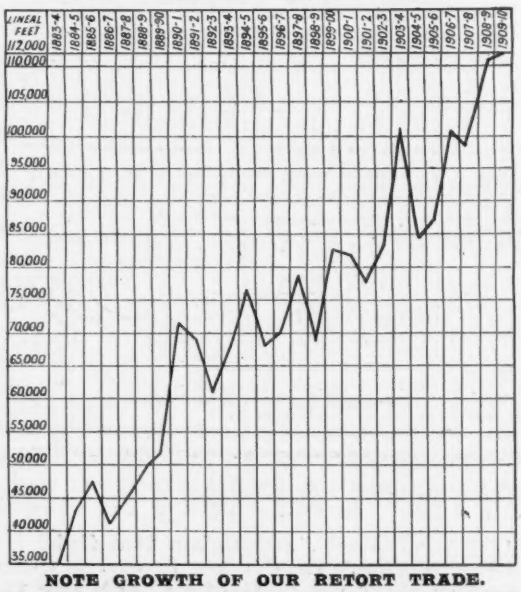

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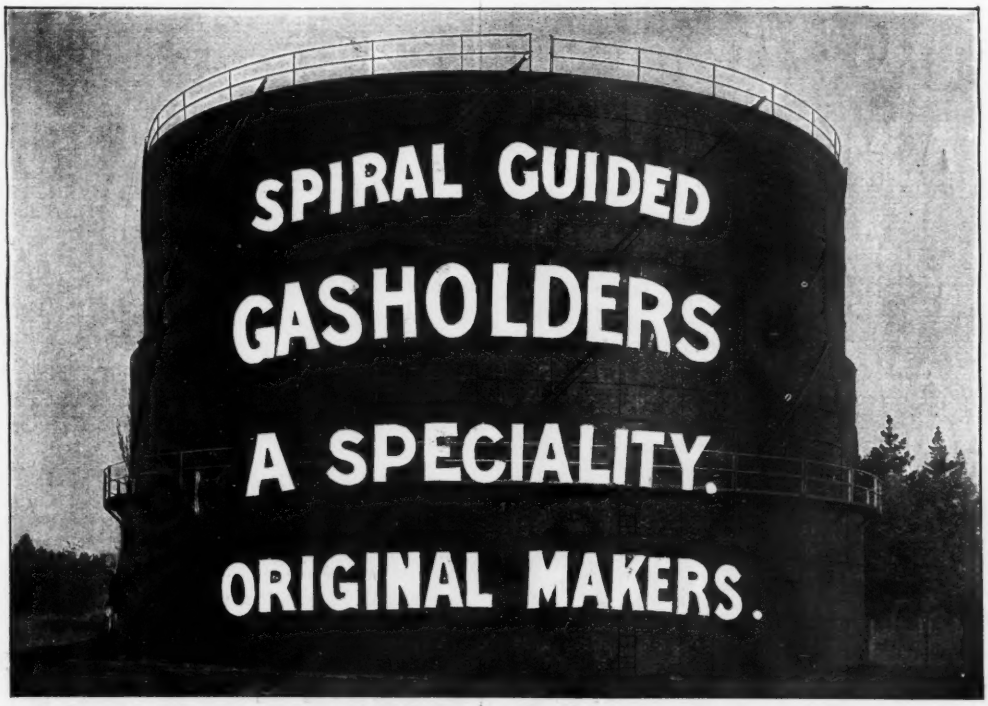

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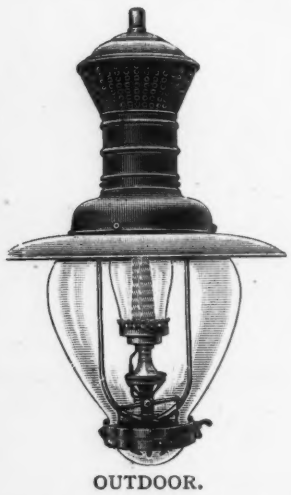

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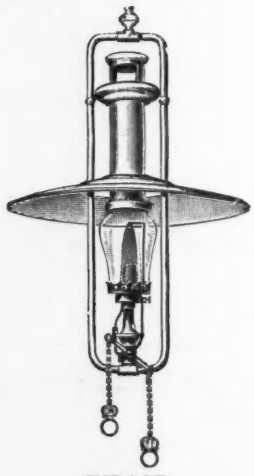

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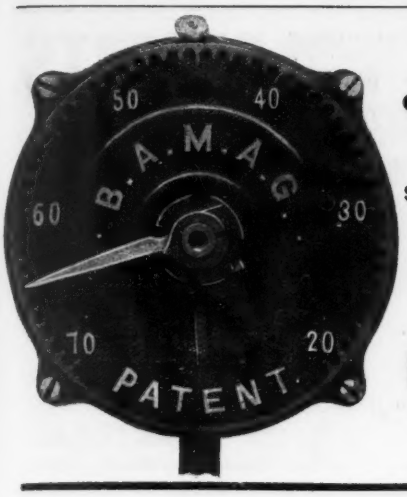

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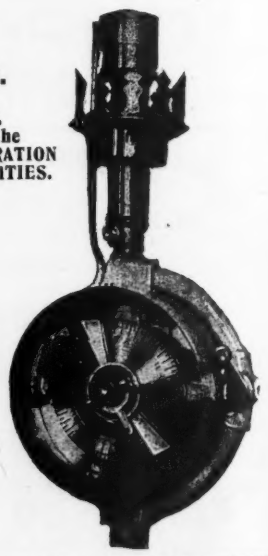

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LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
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BRITISH MADE.

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Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

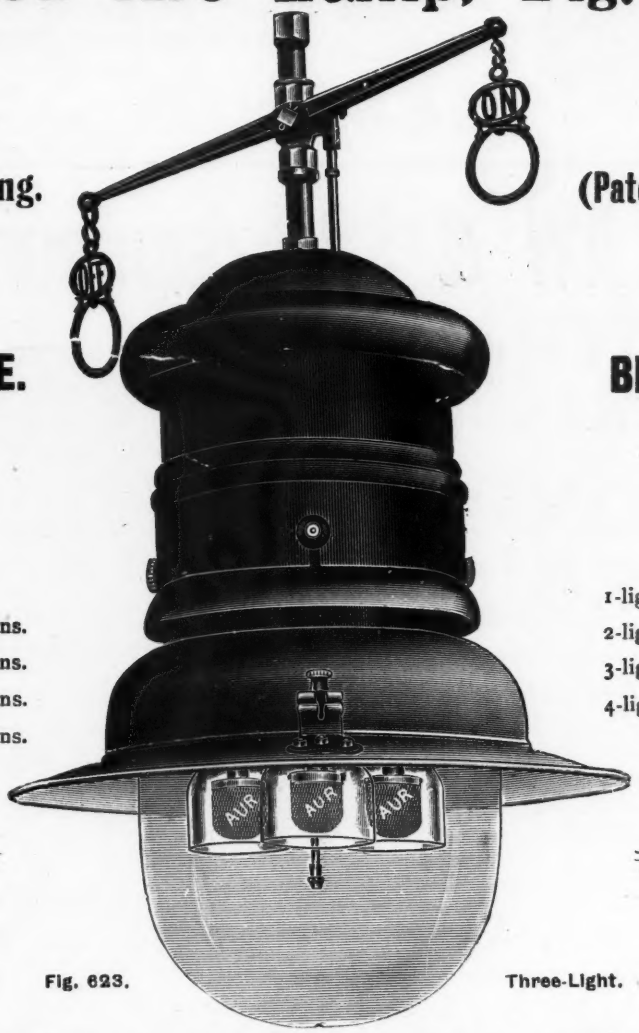

Fig. 623. Three-Light.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

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2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

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Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

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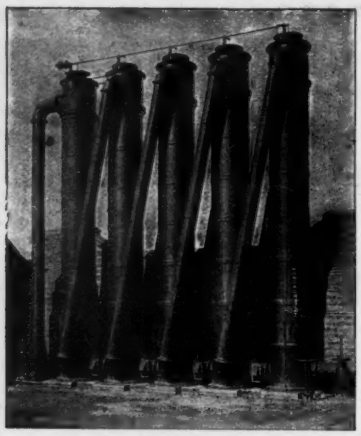

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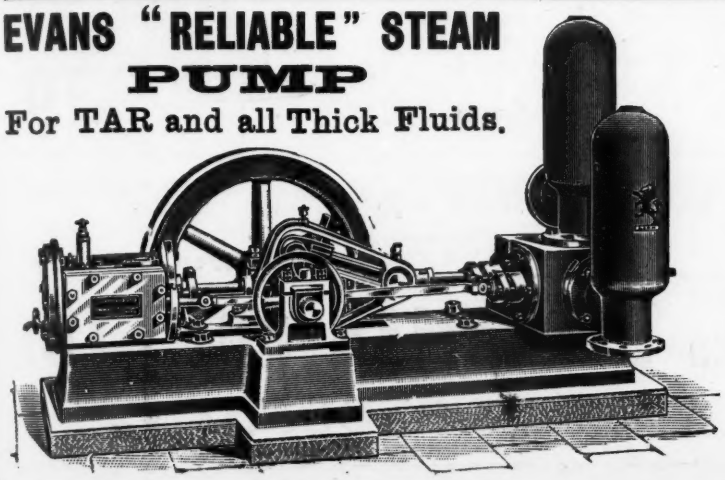

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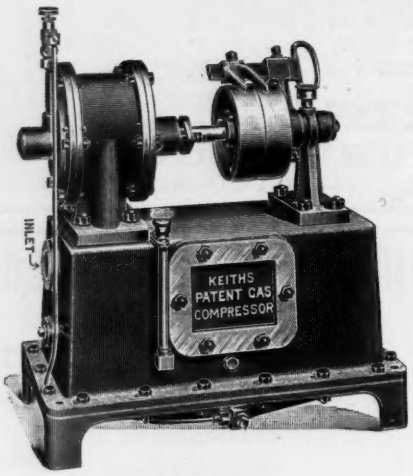

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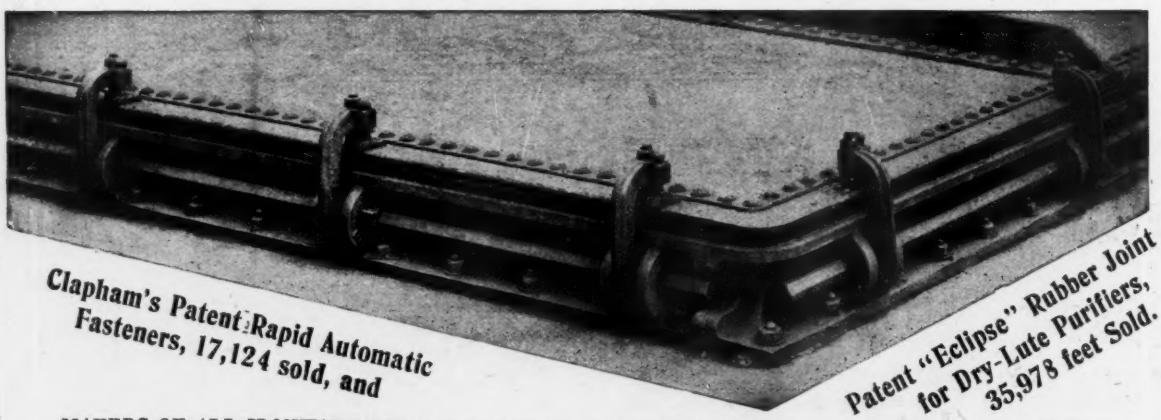

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